THE INSECTS AND ARACHNIDS OF CANADA

PART 10

The Spittlebugs of Canada

Homoptera: Cercopidae

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Frontispiece. The Meadow spittlebug, *Philaenus spumarius* (Linnaeus); adults, molting chambers, and spittle masses on Common mugwort (*Artemisia vulgaris*).

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Preface

It is my hope that this publication will be of interest to the specialist and the amateur alike. To entomologists, it offers the first synthesis of much scattered information on spittlebugs; not just the first in Canada, or in North America, but apparently the first such compendium in the world. The considerable taxonomic emendations, range maps, and corrected biological information should be of interest to specialists familiar with spittlebugs. It is also hoped that the style of presentation, the numerous illustrations, and the brevity of description together with the short and simple identification keys will attract the amateur, and encourage more people to take up the fascinating study of entomology.

Students of entomology familiar with neither the principles and practice of taxonomy nor with identification keys should consult the excellent summaries on these topics found in A. B. Klots' *Field Guide to the Butterflies of North America, East of the Great Plains* of the Peterson Field Guide Series, published by Houghton Mifflin Co., Boston in 1951.

Although this publication technically covers the spittlebugs of Canada only, workers throughout the United States will find most of their species included. The exceptions are mostly in the genus *Clastoptera* Germar, for which there is already an excellent compendium on the North American fauna (Doering 1928).

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Introduction

The sight of a foamy globule adhering to a grass stem, or embedded among pine needles, or pendant on the slender twigs of bushes is so familiar a sight to many Canadians that it seldom attracts curiosity. More frequently it excites disgust: particularly among children barefoot in a meadow, or among picnickers seeking a dry spot to spread their feast. Yet this is a glimpse of a truly exotic facet of entomology, for buried beneath the glistening bubbles is a living insect, a spittlebug.

Spittlebugs are generally abundant, yet seldom noticed. Adults are so alert and such prodigious jumpers that they are usually unseen. General collecting with a sweep net usually turns up hundreds of individuals. These insects so closely resemble their more familiar relatives, leafhoppers, that they are frequently confounded with the latter even by incautious entomologists. The young, living as they do in "spittle masses," are completely screened from view. Wiping away the bubbles with care and patience, will reward the curious with only a squat, pale lump that might be mistaken for a bud; until it stretches its legs, pulls itself free of the stickly fluid, and clambers with rapid strides away from danger.

The species of spittlebugs and their way of life are poorly known. Fewer than half the species in Canada had been reported prior to 1977. Life history studies have been conducted on only 10 of these, and the information available is still fragmentary. The immatures of some of the most common species remain unknown. Obviously, much taxonomic and rearing work remains to be done.

Life history

The biology of only a few species of Cercopidae is known, and hence it is difficult to generalize about their behavior. Most of the following information is gleaned from papers on the economics of various species of the genera *Philaenus* Stål (Osborn 1916, Mundinger 1946, Weaver and

King 1954), *Neophilaenus* Haupt (Osborn 1916, Garman 1921), *Aphrophora* Germar (Capanni 1894, Walden 1917, Metcalf and Barber 1929, Speers 1941, Anderson 1947*b*, Severin 1950, Kelson 1964), *Lepyronia* Amyot & Serville (Doering 1922, Ossiannilsson 1950), and *Clastoptera* Germar (Lintner 1889, Garman 1923, Bennett and Hughes 1963). Where it seems important to note exceptions to the generalities cited, these are marked with the letters A, C, L, N, and P to designate the genera *Aphrophora*, *Clastoptera*, *Lepyronia*, *Neophilaenus*, and *Philaenus*, respectively.

Gravid females usually lay their eggs in the fall, but sometimes also in midsummer (A, C, N), or in early spring (A, L) after overwintering under ground litter or in crevices in bark. Relatively few eggs are laid, usually not exceeding 35 per female, but occasionally up to 50 may be laid (L, P). Some individuals may lay only about 10 eggs (A, N, P). The eggs are usually inserted into the plant tissue by means of the female's knifelike ovipositor, which cuts a longitudinal (A, L) or diagonal (C) slit in a needle, stem, or petiole. Other spittlebugs may simply insert the eggs into crevices, such as needle sheaths, leaf sheaths of grasses, under bud scales, or under bark (Baker 1972). The few eggs that are laid at one time are embedded in a whitish gluelike substance which tears to expose the egg shortly before the young insect, or nymph, hatches. The egg shell is broken with the aid of a hardened plate, or egg burster, on the outer embryonic cuticle, which the young insect presses against the shell.

Newly hatched spittlebugs are extremely active, rambling over the plant on which the eggs were laid, until a suitably succulent feeding site is found. Some feed on the aerial parts of the plant, while others feed on the subterranean root crowns. They may wander a considerable distance, or even drop from tree branches to the ground before reaching their host plant (A). Having selected a feeding site, the young insect inserts its beak and proceeds to draw sap. A filtering chamber in its oesophagus (Snodgrass 1935) passes much of the excess water (and a considerable amount of sugar) directly to the posterior part of the gut. This bypass results in more sap being ingested than digested, and the excess flows from the anus and adheres to the plant and the nymph. Soon enough fluid gathers in a shining droplet to cover the tiny insect entirely. The nymph breathes by means of a tubelike canal below its abdomen, which is formed by the large plates fringing the abdomen and almost meeting below the body; the breathing pores, or spiracles, lie within this canal. The air in the canal is replenished by the thrusting of the tip of the abdomen outside the droplet.

Spittlebug nymphs grow in a series of five stages, or instars, each separated by a molt which permits a larger cuticle to form around the body. These molts usually occur within the fluid in which the nymphs live; the cast-off skins remain clinging to the plant, or floating in the fluid.

As the insect grows in size, its droplet increases in size and bubbles begin to appear. The first of these bubbles may be due to the breathing activity of the nymphs, but by the time the second instar is reached the nymph actively begins to produce bubbles, thus permitting a larger liquid

mass to accumulate around its body. This remarkable process of bubble production involves vigorous motions of the abdomen: the air canal is filled with air as the abdomen is thrust outside the fluid mass; the abdomen is then strongly contracted within the fluid, forcing a bubble out of the tip. Dipping or rolling motions of the abdomen accompanied by contractions produce several bubbles before the air supply need be replenished. Enough bubbles can be made to cover its body in 15–30 min. The bubbles do not immediately collapse, as the fluid is mixed with a sticky secretion exuded from the side of the abdomen.

Spittlebug nymphs are generally regarded as helpless creatures, but their behavior is more akin to indolence. Although generally sedentary, and sometimes remarkably difficult to dislodge, they may become restless and agile when disturbed. They will then begin to wander apparently aimlessly over their host and grope in the air at the edge of leaves. "They have a comical appearance when out of their spittle mass. Their legs are long and they walk with their bodies lifted high in the air. Occasionally they extend their abdomen in the air at right angles to their body, first expanding and then contracting it in a telescopic manner; they do this even while they walk." (Doering 1922). When they fall to the ground they may perish if the sticky fluid on their body makes them adhere.

There may be a variety of reasons for such wandering behavior. The nymphs are apparently sensitive to the abundance of sap, and will move from a cut or withering plant with surprising celerity. Disturbances in their neighborhood will sometimes also lead them to wander away. Some hosts are apparently preferred over others; the bugs are not content to remain long in one place until the preferred host is found.

Having selected a new feeding site, a nymph takes its position head down, inserts its beak, and begins to exude more fluid. When the fluid begins to fill the air canal, it is forced out by contractions of the abdomen, and bubble formation commences. This action is interrupted by irregular resting periods. As the bubbles accumulate around the abdomen, the nymph uses its two front pairs of legs to kick the bubbles forward. Kicking and wallowing motions continue with bubble formation until the insect is again buried in foam.

Some nymphs, in wandering, encounter the spittle masses of other nymphs, and enter these, to which they then add more bubbles. In this way a great number of nymphs may eventually occupy the same mass. One such spittle mass on a weed was 30 cm long, and housed nearly 70 individuals (L). Spittle masses on trees may be even larger, and contain hundreds of individuals (A).

Nymphs take at least 1 month to develop fully, and poor weather or unhealthy food plants may extend the growth period up to 3 months. Under ideal conditions the early instars may molt within 2 days. Later instars take longer to develop. The last nymphal instar requires a minimum of 6 (N) to 10 (L) days' growth, with an average time of 9 (N) to 11 (A, L) days.

The last nymphal instar differs considerably from the previous instars in appearance (Figs. 83, 84). Short wing pads become obvious, and the body changes color, usually either losing all its dark pigmentation (A, N, P), or becoming entirely blackish, obscuring the pale yellow, orange, or red color of the abdomen (A, C, L).

The nymphs of only a few spittlebug species make their final molt within the nymphal spittle mass (N). The full-grown nymph of other species may emerge from the fluid, and cling to an exposed part of the stem or branch, where the drying spittle fluid on its body adheres the shed cuticle to the plant (A, C). Those of other spittlebug species select an open but usually partly shaded situation on the underside of a leaf or grass blade, and construct a new spittle mass. This mass is more gelatinous than the previous spittle masses, and soon dries and hardens around the insect (A, L, P, *Prosapia*). "This sphere is made of a lower solid mass of bubbles and an upper hollow hemisphere formed of a single layer of almost uniform sized and relatively transparent bubbles. On the lower solid mass the nymph comes to rest, partly dries its skin, then splits it down the back from end to end and spreads it out like a rug on the floor. Standing on this raft, and sheltered by the glittering dome of bubbles above, it spreads out its wings and dries them at leisure. This usually occupies the morning and when it finally leaves its frothy bower it leaps free, spreads its wings, and is away like a flash." (Ball 1928). The empty chamber with its round exit hole may remain for some time in the field, and numbers of these may occasionally be found.

The adult has quite different behavior from its immature forms. Usually indolent, it walks slowly and awkwardly, dragging its hind legs. The hind legs are used only for its powerful leaps. The bugs are agile in jumping, but clumsy in landing, seldom recovering their footing quickly.

When feeding, the adult may sit for hours in one place without changing position. No adult ever forms a spittle mass, but lives instead in exposed situations on leaves, or hugging a stem or twig. It apparently relies upon its mottled color and its remarkable dodging and jumping abilities for protection against predators.

The feeding of adult spittlebugs causes severe loss of sap. The ingested sap passes through the filter chamber, as in the nymphs, and is emitted as droplets of a clear, sugary liquid known as honey dew. These droplets are ejected forcibly over the head (Speers 1941) with a faint cracking sound (Mundinger 1946) and fall to the ground at a rate of up to 200 drops an hour (Doering 1922).

Adult spittlebugs are unusually long-lived insects. They survive for 6 months or more and generally lay their eggs long after they emerge. In some species, however, adults mate within a few days after emergence, and their eggs hatch as a second summer brood in about 2 weeks, maturing before the autumn (C). A third brood may also be produced in tropical countries (Bennett and Hughes 1963). Such double- and triple-brooded species

appear to have adults of both sexes continuously through the summer, as the first generation is still living when the next emerges. By contrast, single-brooded species have a marked change in proportions of males and females as the year progresses. In spring, males are the first to emerge, and then outnumber the females, but as the males also die earlier, a much larger proportion of females will be found in late summer and fall (Weaver and King 1954).

Predators, parasites, and disease

Spittlebugs are generally little affected by predators, parasites, and disease, as is demonstrated by the rather low number of eggs laid by each female. By contrast, other insects often lay hundreds of eggs, thus compensating for high mortality rates. Egg parasitism has not been reported above the 10% level (Weaver and King 1954), probably because the eggs are laid in small numbers, and concealed in crevices and slits. The nymphs are protected equally against predators, parasites, and disease by their envelope of froth, which only a few insects have been able to penetrate successfully. Adults are protected from predators by their usually cryptic coloration, sedentary behavior, and prodigious leaps, and from most parasites by their horny integument. In all, only three cases of local spittlebug control by parasites and disease have been reported (Craighead 1950, Bennett and Hughes 1963, Whittaker 1969).

Predators of spittlebugs include birds (Weaver and King 1954), shield bugs or Pentatomidae (Osborn 1916, Garman 1923), plant bugs or Miridae (Osborn 1922), assassin bugs or Reduviidae (Knull 1932), solitary wasps or Sphecidae* (Bohart and Menke 1976), flower flies or Syrphidae (Williams 1921), and spiders or Araneae and harvestmen or Opiliones (Weaver and King 1954). In general, birds catch adult spittlebugs on the wing, while arthropods attack nymphs, sometimes inside the spittle masses, but more frequently when they are partly or wholly exposed (Speers 1941).

Parasites that attack spittlebug eggs are chalcidoid wasps of the families Mymaridae and Aphelinidae (Milliron 1947*a*, *b*). Chalcids of the family Encyrtidae parasitize the nymphs by probing the spittle masses with their ovipositors and laying their eggs directly on the nymph (Bennet and Hughes 1963). Twisted-winged flies or Strepsiptera also parasitize nymphs of spittlebugs (Bohart 1946, Weaver and King 1954); their triungulinid larvae probably actively seek out the spittle masses. Bigheaded flies or Pipunculidae (Whittaker 1969) and nematodes (Weaver and King 1954) infest adults, but probably enter the host during the nymphal stage of the spittlebug after the latter leaves the spittle mass before constructing a molting chamber and completing transformation to the adult. Mites may be found on adults (Knull 1932) but these are probably merely being

*In six genera of Gorytini and one each of Alyssonini and Psenini.

transported, and not feeding on the spittlebug. Similarly, fruit fly larvae (family Drosophilidae) may be found in the spittle mass, but apparently do not feed on the spittlebug (Garman 1923).

The only known disease of spittlebugs is caused by a fungus, *Entomophthora aphrophora*, which attacks adults of the genus *Aphrophora* (Knull 1932, Craighead 1950). Records of this disease on "*Philaenus spumarius*" (Weaver and King 1954) apparently refer to *Aphrophora alni*.

Economics

The economic importance of spittlebugs is generally underestimated. Spittle masses, when abundant, are a trivial nuisance and this is sometimes thought to be the most serious spittlebug-caused problem. However, a great amount of damage of a less obvious kind can be caused by infestations. Because this damage is less apparent than that caused by chewing insects, it often passes unnoticed and unstudied.

Spittlebugs when feeding take sap from the plant in considerable quantities, and can seriously interfere with the growth of trees and crops (Speers 1941). Infestations in meadows may cause a reduction in yield of up to a third (Osborn 1916). Puncturing of plant tissues by the insect's beak deforms leaves (Osborn 1922, Mundinger 1946, Baker 1972), forms galls (Ossiannilsson 1950), blasts tips (Osborn 1916), defoliates branches (Bennett and Hughes 1963), or prevents proper formation of fruit and seeds (Osborn 1916, 1922, Mundinger 1946, Kelson 1964, Baker 1972). Exudates from punctures may block breathing pores (Capanni 1894), and in resinous plants pitchy exudates and resin-filled pockets form in the sapwood, which block the vessels and may eventually kill terminal branches or even whole trees (Speers 1941, Anderson 1947*a*, Craighead 1950).

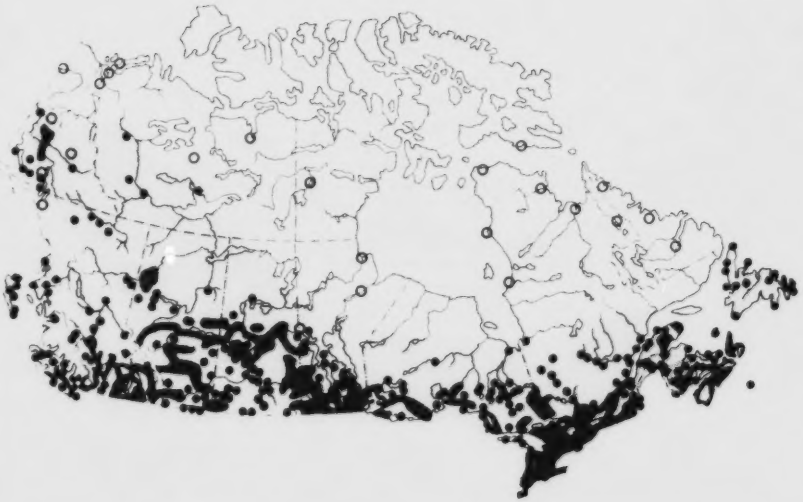
The punctures caused by feeding provide excellent sites for invasion by molds and other plant pathogens (Speers 1941, Anderson 1947*a*, Craighead 1950). Spittlebugs are also vectors of the causal agents of plant diseases such as gummosis of peaches, peach yellows, lucerne dwarf disease (Emeljanov 1972), alfalfa dwarf (DeLong and Severin 1950), Scotch pine blight (Speers 1941), and Pierce's disease of grapevines (Severin 1950). The list of spittlebug-transmitted diseases is not as extensive as that of leafhopper-borne diseases, probably reflecting the lack of study of spittlebugs rather than the benign nature of their feeding.

Spittlebugs cause another kind of damage to their host plants by laying their eggs in slits cut in the plant tissue. Egg slits in young twigs may sever the sap tubes and cause dieback (Speers 1941). Where these slits are numerous, the growth of the tree can be stunted, and the appearance of ornamentals disfigured (Metcalf and Barber 1929).

Distribution

Spittlebugs are mostly tropical insects; relatively few species live in temperate regions. They are rarely encountered in the boreal zone and have not yet been found in the arctic. Most species appear to be restricted in the northern limit of their ranges by growing-season temperatures (as measured by degree-days above 5.5°C). Canadian spittlebugs are mostly found within the 1400-degree-day zone (Maps 3, 17, 21); 10 extend their range into the 1100-degree-day zone (Maps 9, 26), of which only three live within the 800-degree-day zone (Maps 19, 32, 34), and only a single northern-adapted subspecies (*Philaenus spumarius spumarius*) has been found north of the 800-degree-day zone. By contrast, leafhoppers (Cicadellidae) may be found far into the arctic (Map 1).

The least hardy species live on the shores of the Niagara Peninsula of Ontario (Maps 2, 8, 13).



Map 1. Areas of Canada where spittlebugs and leafhoppers have been sampled. Black spots and areas: spittlebugs collected; white spots: many leafhoppers but no spittlebugs collected; shaded: region of summer temperatures (above 5.5°C) of more than 800 degree-days per year.

Some species of spittlebugs are most frequently encountered within the range of their favored host plant, but their distribution is seldom limited strictly by that plant's distribution (Maps 14, 20, 22). Only a very few spittlebugs have such a narrow range of host plants as to be restricted by the distribution of their hosts (Maps 6, 7, 31).

Other, less obvious limiting factors appear to be the general vegetation of the area in which the species live (Maps 4, 5, 24, 25, 29) or the length of the frost-free season (Map 35). A few species are limited to shorelines (Maps 15, 16, 33) and arid areas (Maps 11, 12). Species introduced from Europe are generally found within a limited radius of their place of introduction (Maps 18, 27, 30, 34).

Structure

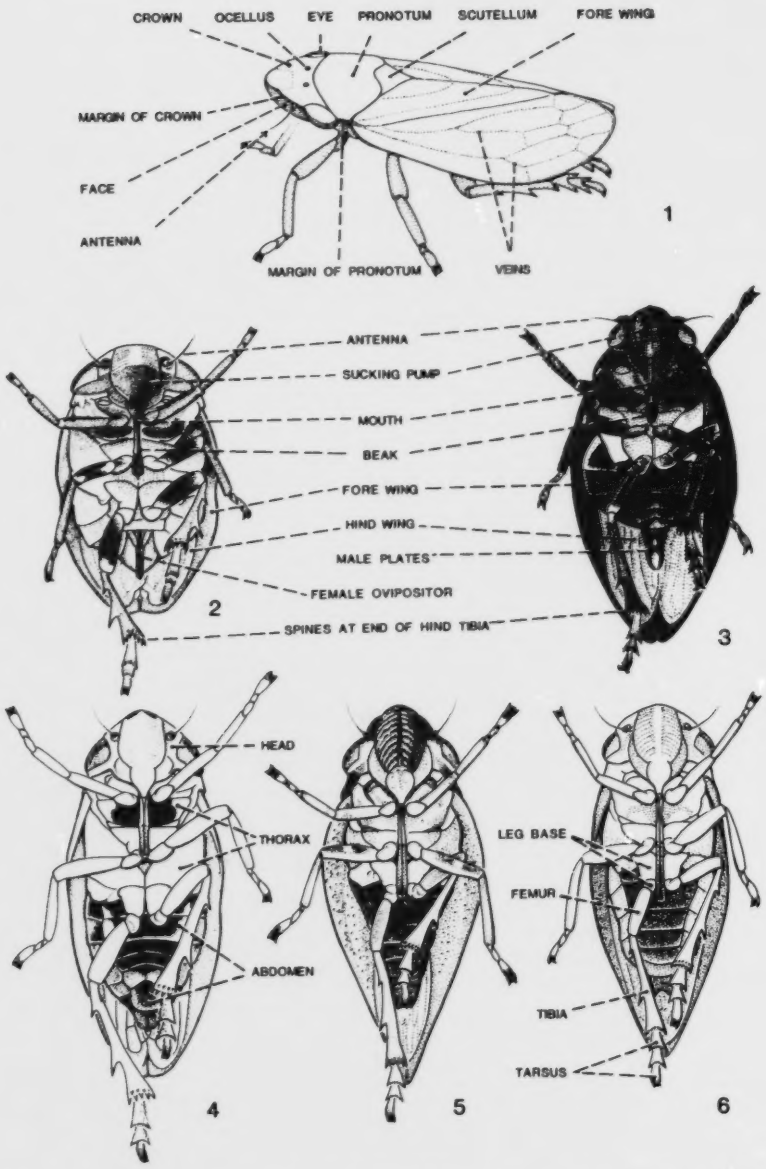
An elementary knowledge of the structure of spittlebug adults is necessary for identification of the species. More detailed accounts of spittlebug morphology can be found elsewhere (Doering 1922, Snodgrass 1935, Hamilton 1982). Technical terms frequently used in scientific papers, but not discussed here, may be found in the glossary.

Spittlebugs (like most insects) have three distinct body sections: head, thorax, and abdomen. Their body form is greatly compacted, obscuring these divisions, although the actual connections between the sections are narrow. The sections of the body are most clearly visible from below (Figs. 2–6).

The *head* is more or less conical, and has an upper part (the *crown*) and a lower part (the *face*) corresponding to those parts visible from directly above, and directly below, respectively. There is usually a distinct angle (the *margin of the crown*, Fig. 1) between the upper and lower parts of the head. The compound *eyes* are large, occupying the entire sides of the head (Fig. 1). Between them, the head is dominated by the greatly inflated outer surface of the *sucking pump** which occupies most of the face (Figs. 2, 3) and also extends onto the crown (Fig. 38), forming a broadly oval or bean-shaped area just in front of the simple eyes, or *ocelli*. The *antennae* are inserted just below the margin of the crown in front of the compound eyes. The *mouth* with its projecting *beak* (Figs. 2, 3) extends backward between the bases of the front legs.

The boxlike *thorax* bears the three pairs of legs and two pairs of wings. The front two pairs of legs are similar to each other. The hind legs are somewhat longer and stouter, and bear prominent spines on the sides and near the tips. Each leg is divided into seven articulated joints. The separation line between the first two is often difficult to distinguish. These

*Technically called the *frons*, but also variously denoted the *frontoclypeus* or *postclypeus*. The morphology of this region of the head is discussed in detail by Hamilton (1981).



Figs. 1–6. Structure of spittlebugs. 1, *Neophilaenus lineatus* (Linnaeus), viewed from above; 2, *Clastoptera obtusa* (Say), viewed from below; 3, *Prosapia ignipectus* (Fitch), viewed from below; 4, *Philaenus spumarius* (Linnaeus), viewed from below; 5, *Aphrophora* (*Pinimber*) *cribrata* (Walker), viewed from below; 6, *Aphrophora* (*Plesiommata*) *gelida* (Walker), viewed from below.

first two joints are short compared to the rest of the leg; they make up the *leg base* (Fig. 6). The first long joint beyond these is the *femur;* the second is the *tibia.* The three terminal joints form the foot, or *tarsus,* which is tipped with a pair of claws and a central adhesive pad.

The wings are thin and nearly flat, with thickened struts (the *veins*) giving structural strength. The fore wings are thicker, heavier, and darker than the membranous and transparent hind wings. Only the latter are used in flight, the fore wings acting mainly as a protective cover when the insect is at rest.

The globular or tapered *abdomen,* concave below, is composed of telescoping segments, and the only appendages it bears are the genitalia. Adult females are readily distinguished by their long, slender *ovipositor* (Fig. 2), which may be up to half the length of the abdomen. Adult males have instead a short pair of blunt or tapered processes, the subgenital *plates* (Figs. 3–6), which serve to protect the copulatory apparatus. In some genera the shapes of these plates are important characters for recognition of the species (Figs. 30, 33–35).

The three main body regions are not readily visible when the insect is viewed from above, with its wings folded (Fig. 1). The two visible parts behind the head are a shieldlike extension of the first thoracic segment (the *pronotum*) and the folded fore wings. Between these is exposed a small triangular part of the second thoracic segment, known as the *scutellum.*

Systematics

The following account of the systematics of Canadian spittlebugs is a synthesis of published accounts together with collection data obtained from various institutions across Canada. Only data pertinent to biological studies and field identification are presented here. More technical accounts of the species can be found in the publications listed at the end of this work. It is recommended that nonspecialists have their identifications checked by a specialist, either at the Biosystematics Research Institute of Agriculture Canada at the Central Experimental Farm, Ottawa, or at the U.S. National Museum of Natural History, Washington, D.C. before publishing new information on any species identified by themselves.

Papers on spittlebugs frequently include a multiplicity of names for each species. Where these names have been used for species or subspecies in the New World literature, they are listed in the text, with the oldest, valid name first and subsequent names afterward, as synonyms. Other names from the Old World literature are not listed here. Complete listings of these names may be found in other works (Metcalf 1960, 1962, Hamilton 1977*a*, 1979, 1982). The reader is advised to check the text for references to incorrect identifications, as these are frequent in the spittlebug literature.

Detailed references to the numerous papers on spittlebugs are not given here, but may be found elsewhere (Metcalf 1960, 1962). The following is a summary of important works on the North American fauna: Goding (1895) first reviewed the fauna, and later reviews were published by Ball (1898), Stearns (1923), and Doering (1930). *Aphrophora* was reviewed by Walley (1928) and Doering (1941). The difficult genus *Clastoptera* was thoroughly revised by Doering (1928); subsequently, she added a new record from the southwestern U.S. (1941). Bennett and Hughes (1963) added a new record of a species of *Clastoptera* from Florida. I have added two new species of *Clastoptera* (Hamilton 1977*b*, 1978), and reviewed the North American genera, subgenera, and species of the tribes Philaenini and Aphrophorini (1979, 1982).

Family Cercopidae

Spittlebugs, or froghoppers

Adult spittlebugs, or froghoppers, are distinguished from other insects by their hind tibiae, which are armed on the outer edge with two stout, thornlike spurs, and end in a broadly flared double row of black-tipped spines (Figs. 2-6). They are superficially similar to leafhoppers (Homoptera: family Cicadellidae), but the latter have slender hind tibiae armed with numerous fine hairlike spines in several rows on both the inner and outer edges, and lack the black-tipped spines at the end of the tibiae.

Immature spittlebugs are the only insects to inhabit spittle masses. Rarely, the spittle mass may be invaded by maggots (Garman 1923, Williams 1921), but these maggots are readily distinguished by their lack of legs. Nymphal spittlebugs generally resemble the adults, but lack wings and usually are paler in color (Figs. 81-88).

The systematics of the Cercopidae is based entirely on the adults. Nymphs of *Lepyronia coleoptrata* (Linnaeus) alone may be reliably identified on the basis of the nymphal color pattern (Fig. 88).

The subfamilies and tribes of the Cercopidae are reviewed elsewhere (Hamilton 1982). The five tribes of the Cercopidae represented in Canada may be distinguished by the characters cited in the following key to genera.

Key to genera of Canadian spittlebugs

1. Scutellum much longer than wide (Figs. 42–65) ..... (tribe CLASTOPTERINI) ..... ***Clastoptera*** **Germar** (p. 19)
   Scutellum about as long as wide (Figs. 7–38) 2
2. Head about half greatest width of body (as measured across folded fore wings, Fig. 3) ..... (tribe ISCHNORHININI) ..... ***Prosapia*** **Fennah** (p. 37)
   Head scarcely narrower than body (Figs. 5,6) 3

3. Margin of crown above insertion of antennae consisting of two parallel ridges separated by a groove (Figs. 8–15) ..... (tribe PHILAENINI) 5
Margin of crown above insertion of antennae consisting of a single sharp or blunt edge (Figs. 16–38) 4
4. Fore wings with prominent punctures, not hairy (Figs. 17–27). Beak long, extending to (or beyond) bases of hind legs (Figs. 5, 6) .... (tribe APHROPHORINI) ..... ***Aphrophora*** **Germar** (p. 39)
Fore wings without prominent punctures, often distinctly hairy (Figs. 39–41). Beak short, not extending as far as bases of hind legs (Fig. 4) .... (tribe CLOVIINI) ..... ***Lepyronia*** **Amyot & Serville** (p. 58)
5. Black-tipped spines at end of hind tibia numbering 7–10 (Fig. 4) 8
Black-tipped spines at end of hind tibia numbering 12–16 (Fig. 5) 6
6. Fore wing veins raised. Color yellowish, with strongly contrasting black stripe down middle of back (Fig. 15) ..... ***Paraphilaenus*** **Vilbaste** (p. 62)
Fore wing veins not raised. Color yellowish, with at most a faint brown line down middle of back (Fig. 14), or tawny, with two parallel brown stripes (Fig. 12), or darker all over (Figs. 11, 13) 7
7. Body slender. Tips of fore wings with a few regular dark veins (Fig. 14) .... ***Neophilaenus*** **Haupt** (p. 63)
Body stout. Tips of fore wings with a network of irregular pale veins (Figs. 11–13) ..... ***Philaenarcys*** **Hamilton** (p. 65)
8. Body distinctly hairy. Veins around tips of fore wings forking irregularly (Figs. 9–10) ..... ***Philaronia*** **Ball** (p. 69)
Body smooth, nearly hairless. Veins around tips of fore wings not forking (Fig. 8) ..... ***Philaenus*** **Stål** (p. 71)

Clé des genres de Cercopidés du Canada

1. Scutellum beaucoup plus long que large (fig. 42 à 65) .... (tribu des CLASTOPTERINI ..... ***Clastoptera*** **Germar** (p. 19)
Scutellum à peu près aussi long que large (fig. 7 à 38) 2
2. Tête de largeur à peu près égale à la moitié de la plus grande largeur du corps (mesurée avec les ailes antérieures repliées, fig. 3) ..... (tribu des ISCHNORHININI) ..... ***Prosapia*** **Fennah** (p. 37)
Tête à peine plus étroite que le corps (fig. 5 et 6) 3
3. Bord du vertex au-dessus de l'insertion des antennes comportant deux crêtes parallèles séparées par une gouttière (fig. 8 à 15) .... (tribu des PHILAENINI) 5
Bord du vertex au-dessus de l'insertion des antennes comportant une seule arête effilée ou arrondie (fig. 16 à 38) 4
4. Ailes antérieures marquées de trous distincts, glabres (fig. 17 à 27). Bec long, atteignant ou dépassant la base des pattes métathoraciques (fig. 5 et 6) .... (tribu des APHROPHORINI) ..... ***Aphrophora*** **Germar** (p. 39)
Ailes antérieures sans trous distincts, souvent nettement poilues (fig. 39 à 41). Bec court, n'atteignant pas la base des pattes métathoraciques (fig. 4) .... (tribu des CLOVIINI) ..... ***Lepyronia*** **Amyot & Serville** (p. 58)
5. Épines à bout noir au nombre de 7 à 10 à l'extrémité du tibia métathoracique (fig. 4) 8
Épines à bout noir au nombre de 12 à 16 à l'extrémité du tibia métathoracique (fig. 5) 6

6. Ailes antérieures à nervures proéminentes; insecte jaunâtre marqué d'une bande noire très contrastante au milieu du dos (fig. 15) ..... ***Paraphilaenus*** **Vilbaste** (p. 62)

Ailes antérieures à nervures non proéminentes; insecte jaunâtre marqué tout au plus d'une ligne brun pâle au milieu du dos (fig. 14), ou insecte fauve marqué de deux bandes brunes parallèles (fig. 12), ou entièrement plus foncé (fig. 11 et 13) 7

7. Corps élancé. Bout des ailes antérieures marqué de quelques nervures foncées régulières (fig. 14) ..... ***Neophilaenus*** **Haupt** (p. 63)

Corps trapu. Bout des ailes antérieures marqué d'un réseau de nervures pâles irrégulières (fig. 11 à 13) ..... ***Philaenarcys*** **Hamilton** (p. 65)

8. Corps nettement poilu. Nervures du bout des ailes antérieures à bifurcations irrégulières (fig. 9 et 10) ..... ***Philaronia*** **Ball** (p. 69)

Corps lisse et presque glabre. Nervures du bout des ailes antérieures sans bifurcation (fig. 8) ..... ***Philaenus*** **Stål** (p. 71)

Genus *Clastoptera* Germar

Figs. 42–80

Adults. Distinguished from all other Canadian spittlebugs by the small globose form, elongate scutellum, prominent folded membranous fore wing tips, and blackened convex spot near the tips of the fore wings.

One or two broods per year (Garman 1923) on various broad-leaved herbaceous plants and various trees and shrubs.

Key to Canadian species-groups of *Clastoptera*

1. Entire lower half of face yellow, strongly contrasting with black upper half (Fig. 66) ..... ***proteus***-group (p. 20)

Lower half of face marked with dark near mouth (Fig. 67), **or** upper half of face pale (Figs. 68, 71–75) 2

2. Body black (Fig. 47), with face largely yellow (Figs. 67, 68), **or** body brown to yellow, with not more than two dark lines across pronotum (Figs. 48–53) ..... ***obtusa***-group (p. 24)

Body black (Fig. 62), with face almost entirely black (Figs. 69, 70), **or** body yellow with numerous dark lines across pronotum (Figs. 63, 65) ..... ***lineatocollis***-group (p. 33)

Clé des groupes d'espèces canadiennes du genre *Clastoptera*

1. Moitié inférieure de la face entièrement jaune contrastant fortement avec la moitié supérieure noire (fig. 66) ..... groupe ***proteus*** (p. 20)

Moitié inférieure de la face marquée d'une tache sombre près de la bouche (fig. 67), **ou** moitié supérieure de la face pâle (fig. 68 et 71 à 75) 2

2. Corps noir (fig. 47) et face principalement jaune (fig. 67 et 68), **ou** corps variant du brun au jaune et pronotum rayé de pas plus de deux lignes foncées (fig. 48 à 53) ..... groupe ***obtusa*** (p. 24)
Corps noir (fig. 62) et face presque entièrement noire (fig. 69 et 70), **ou** corps jaune et pronotum rayé de nombreuses lignes foncées (fig. 63 et 65) ..... groupe ***lineatocollis*** (p. 33)

The *proteus*-group

Figs. 44–46, 66

Adults. Distinguished from other species-groups of *Clastoptera* by their contrastingly marked face (Fig. 66); the body form is distinctly shorter and more nearly globose than that of the *obtusa*-group.

All species of the *proteus*-group feed on bushes and woody heath plants.

There are four species in the *proteus*-group, of which one (*C. salicis* Doering) is found only in the southern United States (Doering 1928).

These species were included under "*Clastoptera proteus* Fitch" before 1928.

Key to Canadian species of the *proteus*-group

1. Legs brown (Fig. 46) ..... ***hyperici*** **Gibson** (p. 21)
Legs yellow (Figs. 42, 44) 2
2. Fore wings dark, without yellow or orange markings, and crown of head banded with yellow or orange (Fig. 42), **or** each fore wing marked with a single yellow or orange patch (Figs. 43*a*–43*d*) ..... ***proteus*** **Fitch** (p. 22)
Fore wings dark, without yellow or orange markings, and crown of head entirely black (Figs. 44, 45*a*, 45*b*), **or** each fore wing marked with 2–3 yellow or orange bands (Figs. 45*c*, 45*d*) ..... ***saintcyri*** **Provancher** (p. 23)

Clé des espèces canadiennes du groupe *proteus*

1. Pattes brunes (fig. 46) ..... ***hyperici*** **Gibson** (p. 21)
Pattes jaunes (fig. 42 et 44) 2
2. Ailes antérieures foncées sans marque jaune ou orangée et vertex marqué de bandes jaunes ou orangées (fig. 42), **ou** chaque aile antérieure marquée d'une seule tache jaune ou orangée (fig. 43*a* à 43*d*) ..... ***proteus*** **Fitch** (p. 22)
Ailes antérieures foncées sans marque jaune ou orangée et vertex entièrement noir (fig. 44, 45*a* et 45*b*), **ou** chaque aile antérieure marquée de 2 à 3 bandes jaunes ou orangées (fig. 45*c* et 45*d*) ..... ***saintcyri*** **Provancher** (p. 23)

Clastoptera hyperici Gibson

Figs. 46, 66; Map 2

Clastoptera proteus var. *hyperici* Gibson, *in* McAtee 1920:174.
Clastoptera hyperici Gibson: Doering 1928:52.

Adults. Distinguished from other species of the *proteus*-group by the brown legs and distinctly hairy fore wings (Fig. 46), and from *Clastoptera xanthocephala* by lacking dark markings near the mouth (Fig. 66). Length: males, 2.7-3.1 mm; females, 3.2-3.4 mm.

Black, without pale markings except for the yellow lower half of face (Fig. 66); legs brown (Fig. 46).

Rare and local, in southernmost Ontario; also reported from Maryland (McAtee 1920), Virginia, Massachusetts, and the shore of Lake Erie (Ball 1927).

Hosts. Nymphs are unknown, but probably feed on the same hosts as the adults.

Adults feed on Shrubby St. John's-wort (*Hypericum prolificum*) (McAtee 1920) and other native species of the same genus.

Map 2. Collection localities for *Clastoptera hyperici* Gibson.

Clastoptera proteus Fitch

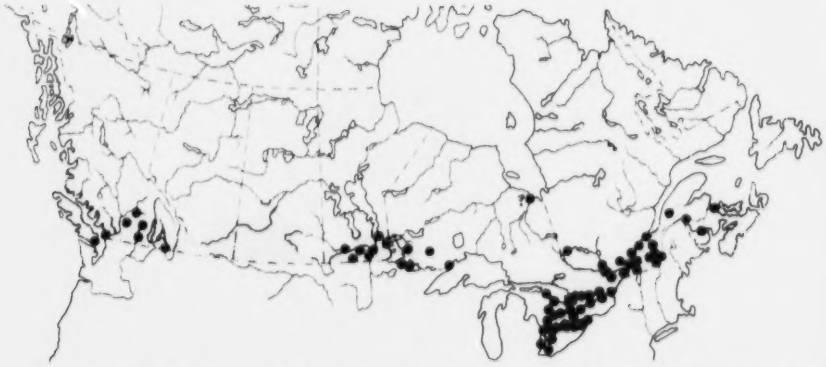
Dogwood spittlebug

Figs. 42, 43, 66; Map 3

Clastoptera proteus Fitch, 1851:54; Doering 1928:34.
Clastoptera proteus var. *flavicollis* Fitch, 1851:54.
Clastoptera proteus var. *cincticollis* Fitch, 1851:54.
Clastoptera proteus var. *maculicollis* Fitch, 1851:54.
Clastoptera proteus var. *nigricollis* Fitch, 1851:55; Doering 1928:41.
Clastoptera proteus var. *flava* Ball, 1895:187.
Clastoptera proteus var. *candens* McAtee, 1920:175.
Clastoptera proteus var. *seminuda* Ball, 1927:108.
Clastoptera proteus var. *osceola* Ball, 1927:108; Doering 1928:43.

Adults. Distinguished from all other species of the *proteus*-group by the yellow-and-black pattern, which forms bands across the head and not more than a single yellow patch on each fore wing (Figs. 42-43). Dark specimens of this species resemble males of *Clastoptera testacea* from above, but differ in their facial markings, which include a black band across the upper part of the face in *C. proteus* (Fig. 66), but not in *testacea* (Fig. 68). Length: males, 2.9-3.5 mm; females, 3.3-4.1 mm.

Black and yellow on upper side, usually mostly black with alternating yellow and black bands across crown; each fore wing usually marked with yellow patch, rarely with most of upper side yellow with a black band across crown (Figs. 42, 43*a-d*); underside yellow except for black band between eyes (Fig. 66). Males tend to be darker than females; more than half the males are without yellow markings on the fore wings, but only about one-ninth the females are so marked. Some specimens may have the yellow markings replaced by orange.



Map 3. Collection localities for *Clastoptera proteus* Fitch. Shaded: region of summer temperatures (above 5.5°C) of more than 1400 degree-days per year.

Abundant in southern Canada and throughout the U.S. (Doering 1928), rarer northward and in the western provinces.

Hosts. Nymphs feed on the twigs of at least five species of bush dogwoods (*Cornus* spp.) (Doering 1942), but are not yet recorded from the tree dogwoods (*Cornus florida* and *C. nuttallii*). Records in the literature of this species feeding on heath plants (Garman 1923, Doering 1942) are probably records of the superficially similar *Clastoptera saintcyri*.

Adults feed on the same hosts as the nymphs (Doering 1942).

Clastoptera saintcyri Provancher

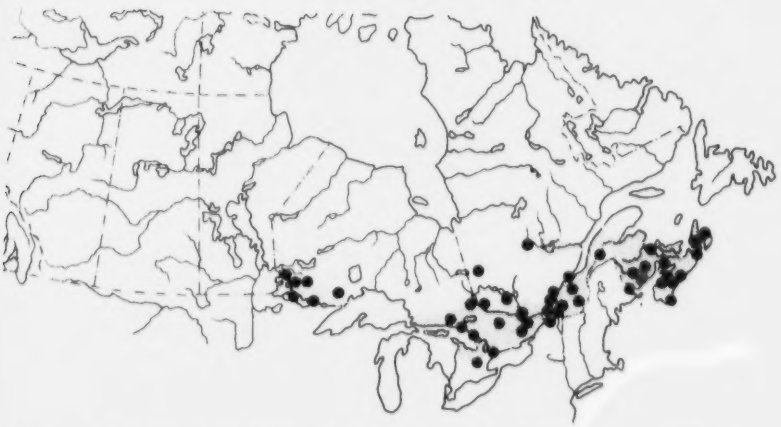
Heath spittlebug

Figs. 44, 45, 66; Map 4

Clastoptera saintcyri Provancher, 1872:351; Doering 1928:45.
Clastoptera proteus var. *vittata* Ball, 1895:187.
Clastoptera proteus var. *anceps* McAtee, 1920:174; Doering 1928:47.

Adults. Distinguished from other Canadian species of *Clastoptera* by the distinctive yellow-and-black pattern, either entirely dark above (Figs. 45*a*, 45*b*) or else boldly patterned with yellow stripes across the head and diagonally across the fore wings (Figs. 45*c*, 45*d*). Length: males, 2.7–3.5 mm; females, 3.2–4.1 mm.

Black to brownish black; underside yellow except for a black band between eyes (Fig. 66); females frequently boldly striped with alternating



Map 4. Collection localities for *Clastoptera saintcyri* Provancher. Shaded: region of mixed coniferous–deciduous forests.

bands of yellow and black on upper side (Figs. 44, 45*a-d*). The proportion of these color forms in any population is extremely variable. Some specimens may have the yellow markings replaced by orange.

Abundant in heath situations in mixed pine-maple woods of Eastern Canada and the eastern U.S. (Doering 1928).

Hosts. Nymphs feed on Large cranberry (*Vaccinium macrocarpon*) (Doering 1942) and probably many other heath plants (Ericaceae).

Adults feed on Blueberry (*Vaccinium* sp.), Bearberry (*Arctostaphylos uva-ursi*), Evergreen shrub (*Leucothoe* sp.), Huckleberry (*Gaylussacia* sp.) (Doering 1942), Leatherleaf (*Chamaedaphne calyculata*), Sweet Gale (*Myrica Gale*), and Bracken (*Pteridium aquilinum*). A few specimens have also been taken on maple (*Acer* sp.), but these are probably strays from heath plants.

The *obtusa*-group

Figs. 2, 47-59, 67-68, 71-75

Adults. Distinguished from other species-groups of *Clastoptera* by the facial markings: the upper half of the face (between the eyes) is more or less pale, and most species have a dark band across the middle of the sucking pump (Figs. 67, 72-75); if this band is absent, then the entire face is pale (Fig. 68) or the lower half of the face is dark (Fig. 71) obscuring the band. The species of the *obtusa*-group are less globose than those of the other two species-groups.

Most species of the *obtusa*-group feed on deciduous trees and conifers, but several also feed on bushes and broad-leaved herbaceous plants.

The majority of North American species of *Clastoptera* belong to the *obtusa*-group, of which eight are known to occur in Canada, and a ninth may eventually be found. Ten other species are found in the southwestern U.S. (Doering 1928), and *C. undulata* Uhler is found in the Florida Keys (Bennett and Hughes 1963). Before 1928, most of these species were included under the name *Clastoptera obtusa* (Say).

Key to Canadian species of the *obtusa*-group

1. Pronotum entirely black or brown without pale bands (Fig. 47) ..... ***xanthocephala*** **Germar** (p. 25)
   Pronotum entirely pale (Fig. 49), or with pale bands (Figs. 50-53) 2
2. Face pale, unmarked, with fine brown lines (Fig. 68) ... ***testacea*** **Fitch** (p. 26)
   Face marked with extensive brown or blackish areas (Figs. 71-75) 3
3. Hind margin of pronotum darker than fore margin, tawny brown to blackish brown (Figs. 50-53) 7

Hind margin of pronotum pale (Figs. 54–59) 4
4. Inhabiting southern Ontario and Quebec 6
Inhabiting southern British Columbia 5
5. Robust and large (Fig. 57), more than 1.8 mm wide across head. Body with wings folded usually more than 4.1 mm long ..... ***juniperina*** **Ball** (p. 27)
Smaller (Fig. 55), less than 1.8 mm wide across head. Body with wings folded usually less than 4.1 mm long ..... ***doeringae*** **Hamilton** (p. 28)
6. Pronotum banded with black or red brown (Fig. 56). Host: Eastern red cedar (*Juniperus virginiana*) ..... ***arborina*** **Ball** (p. 29)
Pronotum unmarked (Figs. 58, 59). Host: hickories (*Carya* spp.) ..... ***achatina*** **Germar** (p. 30)
7. Face dark near mouth (Figs. 71, 73). Inhabiting Canada east of the Rocky Mountains (Map 27) ..... ***obtusa*** **(Say)** (p. 31)
Face banded with blackish across center of sucking pump, not darker near mouth (Fig. 74). Inhabiting British Columbia (Map 28) ..... ***ovata*** **Doering** (p. 32)

Clé des espèces canadiennes du groupe *obtusa*

1. Pronotum entièrement noir ou brun sans bande pâle (fig. 47) ..... ***xanthocephala*** **Germar** (p. 26)
Pronotum entièrement pâle (fig. 49), **ou** marqué de bandes pâles (fig. 50 à 53) 2
2. Face pâle, sans tache, mais rayée de fines lignes brunes (fig. 68) ..... ***testacea*** **Fitch** (p. 26)
Face marquée de grandes taches brunes **ou** noirâtres (fig. 71 à 75) 3
3. Bord postérieur du pronotum plus foncé que le bord antérieur, variant du brun fauve au brun noirâtre (fig. 50 à 53) 7
Bord postérieur du pronotum pâle (fig. 54 à 59) 4
4. Habite le sud de l'Ontario et le Québec 6
Habite le sud de la Colombie-Britannique 5
5. Robuste et gros (fig. 57); largeur de la tête supérieure à 1,8 mm. Longueur du corps (avec les ailes repliées) généralement supérieure à 4,1 mm ..... ***juniperina*** **Ball** (p. 27)
Plus petit (fig. 55); largeur de la tête inférieure à 1,8 mm. Longueur du corps (avec les ailes repliées) généralement inférieure à 4,1 mm ..... ***doeringae*** **Hamilton** (p. 28)
6. Pronotum marqué de bandes noires ou brun rougeâtre (fig. 56). Hôte: cèdre rouge (*Juniperus virginiana*) ..... ***arborina*** **Ball** (p. 29)
Pronotum concolore (fig. 58 et 59). Hôte: caryer (*Carya* spp.) ..... ***achatina*** **Germar** (p. 30)
7. Face foncée près de la bouche (fig. 71 et 73). Habite le Canada à l'est des Rocheuses (carte 27) ..... ***obtusa*** **(Say)** (p. 31)
Face marquée d'une bande noirâtre au niveau du centre de la pompe suceuse, pas plus foncée près de la bouche (fig. 74). Habite la Colombie-Britannique (carte 28) ..... ***ovata*** **Doering** (p. 32)

Clastoptera xanthocephala Germar

Sunflower spittlebug

Figs. 47, 67

Clastoptera xanthocephala Germar 1839:189; Doering 1928:75.
Clastoptera unicolor Fowler, 1897:205.
Clastoptera xanthocephala var. *glauca* Heidemann, 1901:399.

Adults. Distinguished from other species of the *obtusa*-group by the uniformly dark pronotum. It may be distinguished from the superficially similar dark forms of the *proteus*-group by the more flattened body form (Fig. 47), brown upper part of the head, and black area near the mouth (Fig. 67). Length: males, 2.4-3.0 mm; females, 3.0-4.7 mm.

Black, marked with pale spot at middle of outer edge of each fore wing, and with broad yellow band across face; upper part of head brown or yellowish brown. The fall brood is paler (Ball 1927), chocolate brown, though marked as the spring brood.

Not yet found in Canada. This essentially Caribbean species is abundant in the southern U.S. and has been recorded as far north as Ohio and Maine (Doering 1928). It should be sought in southeastern Canada.

Hosts. Nymphs feed on the aerial parts of many trees, shrubs, and grasses. They prefer sunflower (*Helianthus* spp.) and ragweed (*Ambrosia* sp.) (Ball 1927).

Adults feed on the same hosts as the nymphs.

Clastoptera testacea Fitch

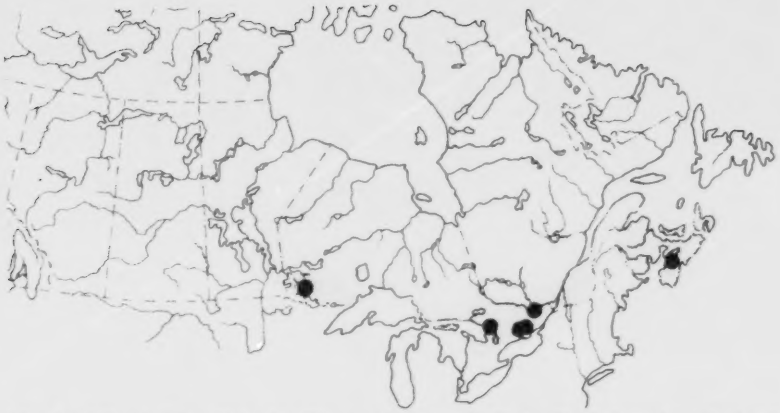
Figs. 48, 49, 68; Map 5

Clastoptera testacea Fitch, 1851:53; Doering 1928:60.
Clastoptera pini Fitch, 1851:53.

Adults. Distinguished from all other species of *Clastoptera* in Canada by the unmarked face (Fig. 68). Males are differently colored from females, and may be confused with species of the *proteus*-group if their faces are not examined. Length: males, 3.1-3.8 mm; females, 4.4-5.2.

Males yellow, boldly patterned with black above (Fig. 48); females orange brown, marked with a black spot at tip of each fore wing (Fig. 49). Some females have their head and scutellum vivid orange red. A rare form of the female is patterned with brown above, as in Fig. 48.

Local, in mixed oak-pine woods of Eastern Canada, south in the Appalachian Mountains to North Carolina (Ball 1927).



Map 5. Collection localities for *Clastoptera testacea* Fitch. Shaded: region of mixed coniferous–deciduous forests.

Hosts. Nymphs are unknown. Records of nymphs of *testacea* on pines (Lintner 1889) probably refer to *Aphrophora* (*Pinimber*) *cribrata*.

Adults feed on oaks (*Quercus* spp.) and pines (*Pinus* spp.) (Fitch 1851, Doering 1942).

Clastoptera juniperina Ball

Figs. 57, 74, 75; Map 6

Clastoptera juniperina Ball, 1919:146; Doering 1928:97.

Adults. Distinguished from *Clastoptera doeringae* by the larger size and more robust build (Fig. 57), and from *C. arborina* by the paler markings. It superficially resembles pale specimens of *C. achatina*, but differs in the pale lower half of its face (Figs. 74, 75). Length: males, 4.1–4.3 mm; females, 4.1–5.0 mm.

Golden yellow, marked with black band (or two patches) across center of sucking pump (Figs. 74, 75), dark brown veins at tips of fore wings, and an oblique brown band across center of each fore wing (Fig. 57). The fore wings of some specimens may be clouded with brown, as in *C. doeringae*, and there may be traces of red brown pronotal bands or a brown spot in the middle of the pronotum.

Rare and local, in southern British Columbia south to Mexico.

Map 6. Collection localities for *Clastoptera juniperina* Ball (△) and *C. doeringae* Hamilton (•). Shaded: distribution of Rocky mountain juniper.

Hosts. Nymphs feed on the aerial parts of "Red cedar" (Ball 1919) (*Juniperus* sp., possibly *scopulorum*) and on Chinese juniper (*Juniperus chinensis*) (Johnson and Lyon 1976). They are probably general feeders on junipers.

Adults feed on "Red cedar" (Ball 1919) and have also been taken on Potato (*Solanum tuberosum*) (Doering 1942).

Clastoptera doeringae Hamilton

Mountain-juniper spittlebug

Figs. 54, 55, 74, 75; Map 6

Clastoptera doeringae Hamilton, 1978:335.
Clastoptera arborina: Doering 1928:94 (not Ball's *arborina*; see next species).

Adults. Distinguished from other pale species of *Clastoptera* by the paler markings and more prominent sucking pump (Figs. 54, 55). Length: males, 3.2–3.9 mm; females, 3.5–4.1 mm.

Ochre yellow to golden yellow; fore wings and pronotum usually clouded with pale brown, marked with black (males) or red brown (females) as follows: a band or spot across center of sucking pump (Figs. 74, 75), two bands across front of pronotum, another at base of scutellum, and an oblique line across center of each fore wing, and veins at tips of fore

wings outlined (Fig. 54). Paler forms may lack the pronotal bands, or may have a dark line down the middle of the pronotum (Fig. 55).

Abundant throughout dry-belt regions of southern British Columbia south to Arizona (Hamilton 1978).

Hosts. Nymphs feed on the aerial parts of Rocky Mountain juniper, or Western red cedar, (*Juniperus scopulorum*).

Adults feed on the same host as the nymphs.

Clastoptera arborina Ball

Red cedar spittlebug

Figs. 56, 74; Map 7

Clastoptera obtusa var. *arborina* Ball, 1927:110.
Clastoptera newporta Doering, 1928:100.

Adults. Distinguished from *Clastoptera doeringae*, its close relative, by the smoothly rounded head and darker markings (Fig. 56). The strongly mottled color pattern immediately distinguishes it from all other species of *Clastoptera*. Length: males, 3.5–3.9 mm; females, 3.7–4.1 mm.

Mottled with yellow, red brown, and black; pronotum banded with black (males) or red brown (females). Females are paler than males, and usually resemble dark males of *C. doeringae* (Fig. 54) except for the color of their pronotal bands.

Map 7. Collection localities for *Clastoptera arborina* Ball. Shaded: natural distribution of Eastern red cedar. Spots outside shaded area represent collections on planted ornamentals of the same host species.

Locally abundant in southern Ontario wherever red cedar is grown, and occurring west to Iowa (Ball 1927) and south to North Carolina.

Hosts. Nymphs are unknown, but probably feed on the same host as the adults.

Adults feed on Eastern red cedar (*Juniperus virginiana*) (Hamilton 1978).

Clastoptera achatina Germar

Pecan spittlebug

Figs. 58, 59, 72, 73; Map 8

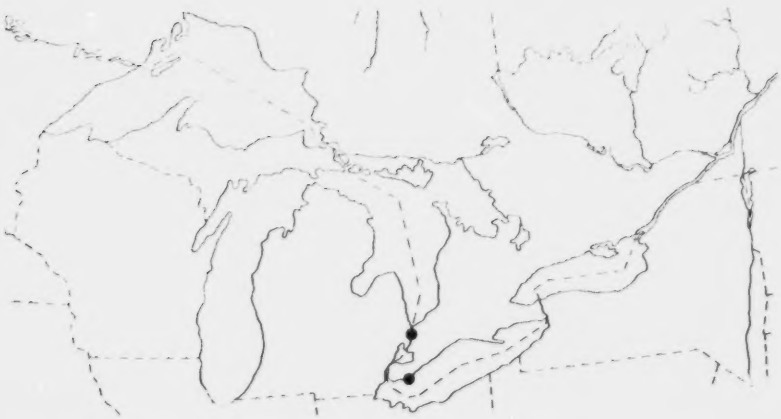
Clastoptera achatina Germar, 1839:187; Doering 1928:69.

Adults. Distinguished from other species of *Clastoptera* by the curved brown band across the fore wings (Fig. 58). Pale forms that lack the band (Fig. 59) may be distinguished from other pale species of *Clastoptera* by the extensive facial markings (Figs. 72, 73). Length: males, 3.7–4.1 mm; females, 4.5–5.0 mm.

Golden orange; face more or less banded and clouded with brown on lower half (Figs. 72, 73); fore wings usually with broad brown band across middle (Fig. 58).

Local, in southernmost parts of Ontario, south to Mexico (Ball 1927).

Hosts. Nymphs feed on hickories (*Carya* spp.) (Garman 1923).



Map 8. Collection localities for *Clastoptera achatina* Germar.

Adults feed on hickories, including Pecan (*Carya illinoinensis*) (Baker 1972), White-heart hickory (*Carya tomentosa*) (Doering 1942), Shagbark hickory (*Carya ovata*), and Bitternut hickory (*Carya cordiformis*). They have also been taken on hazelnut (*Corylus* sp.), maple (*Acer* sp.), and linden (*Tilia* sp.) (Doering 1942), but these are probably strays from hickories.

Clastoptera obtusa (Say)

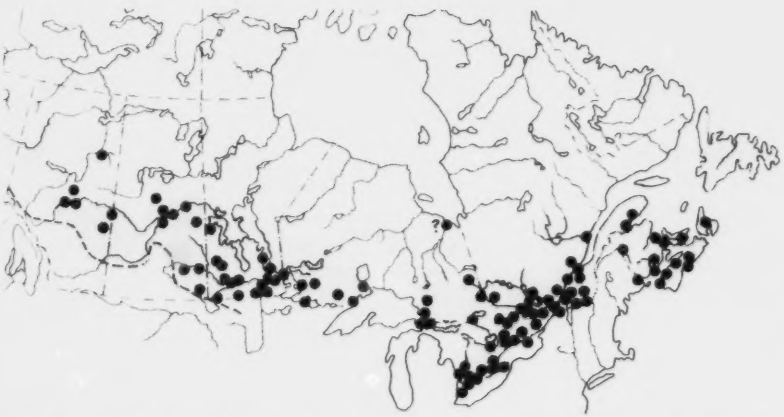
Alder spittlebug

Figs. 2, 50, 51, 71, 73; Map 9

Cercopis obtusa Say, 1825:339.
Clastoptera obtusa var. *tristis* Van Duzee, 1912:508; Doering 1928:66.
Clastoptera obtusa var. *pallida* Ball, 1919:145.
Clastoptera obtusa var. *borealis* Ball, 1919:145; Doering 1928:67.
Clastoptera obtusa: Doering 1928:63.

Adults. Distinguished from other species of *Clastoptera* by the lower half of the face being entirely dark (Fig. 71). Rarely, the dark markings of the face are less extensive (Fig. 73) and resemble those of *C. achatina*. However, *C. obtusa* never has a golden orange pronotum like that of *C. achatina*. Length: males, 3.6–4.7 mm; females, 4.0–5.2 mm.

Brown, blackish brown, or pale tawny brown (Fig. 51), marked with pale bands across crown of head and front of pronotum, and with another



Map 9. Collection localities for *Clastoptera obtusa* (Say). Dotted line: southern limit of range of alder; shaded: range of alder within the region of summer temperatures (above 5.5°C) of more than 1100 degree-days per year.

pale irregular band across middle of fore wings (Fig. 50). The band on the fore wings is sometimes absent, especially in the darkest specimens. Males are usually darker than females.

Abundant in warm areas east of the Rocky Mountains where alder grows, throughout temperate eastern North America (Doering 1928).

Hosts. Nymphs feed on the aerial parts of Speckled alder (*Alnus rugosa*) (Garman 1923, Knull 1932) and are also reported on Wire, or Gray, birch (*Betula populifolia*), Common witch-hazel (*Hamamelis virginiana*) (Garman 1923), Beaked hazelnut (*Corylus cornuta*), and American hop hornbeam (*Ostrya virginiana*). They probably feed on a wide variety of hosts, as do the adults.

Adults feed on the same host as the nymphs (Garman 1923), and in addition feed on Basswood, or American linden, (*Tilia americana*) (Lintner 1889, Ball 1927), Butternut (*Juglans cinerea*), blueberry (*Vaccinium* spp.) (Lintner 1889), willow (*Salix* sp.) (Ball 1927), Horse-chestnut (*Aesculus hippocastanum*), Common pawpaw (*Asimia triloba*), pine (*Pinus* sp.), oak (*Quercus* sp.), Early azalea (*Rhododendron periclymenoides*) (Doering 1942), Shagbark hickory (*Carya ovata*), Balsam poplar (*Populus balsamifera*), hawthorn (*Crataegus* sp.), birch (*Betula* spp.), Blue beech (*Carpinus caroliniana*), and Sweet Gale (*Myrica Gale*).

Clastoptera ovata Doering

Figs. 52, 53, 74; Map 10

Clastoptera ovata Doering, 1928:90.

Adults. Distinguished from *Clastoptera obtusa*, its close relative, by the entirely pale lower half of the face (Fig. 74); the sucking pump is also usually more prominent (Fig. 53). Length: males, 4.0–4.7 mm; females, 4.4–5.3 mm.

Brown, blackish brown, or tawny, with an irregular pale band across middle of fore wing, and with three yellow bands across crown and pronotum (Fig. 52), or with entire front part of body yellow (Fig. 53).

Locally abundant in southern British Columbia, ranging south to northern California (Doering 1928).

Hosts. Nymphs feed on the aerial parts of Sticky laurel, or Snowbrush, (*Ceanothus velutinus*).

Adults feed mostly on Sticky laurel (*Ceanothus velutinus*) but may be found in small numbers on Oregon tea-tree (*Ceanothus sanguineus*). Occasional specimens of this species have been taken on Thimbleberry (*Rubus parviflorus*) and Cascara buckthorn (*Rhamnus purshiana*), but these are probably strays from *Ceanothus* spp.

Map 10. Collection localities for *Clastoptera ovata* Doering. Shaded: region of summer temperatures (above 5.5°C) of more than 1400 degree-days per year.

The *lineatocollis*-group

Figs. 60–65, 69–70, 76–80

Adults. Distinguished from other species-groups of *Clastoptera* by the color pattern: either almost entirely black (including the face, Figs. 69–70), or else yellow with numerous dark lines or bands across the pronotum (Figs. 62–65). Members of this species-group are short and globose, like those of the *proteus*-group, but have fewer pronotal wrinkles (about seven along the midline).

All species of the *lineatocollis*-group feed on arid-adapted plants, especially sagebrush and rabbitbrush (Doering 1942).

Seven species belong to the *lineatocollis*-group (Doering 1928), of which two are known to occur in Canada, and two others may eventually be found. These were included in "*Clastoptera lineatocollis* Stål" before 1928.

Key to Canadian species of the *lineatocollis*-group

1. Both sexes yellow; pronotum bearing 5–7 heavy black bars of equal clarity (Fig. 65)..... ***delicata*** **Uhler** (p. 34)
   Males black (Fig. 62); females• yellow, with pronotum bearing eight or more fine brown lines behind a much wider and darker bar along front edge (Fig. 63)..... 2

•Females can be distinguished by their large ovipositor (Fig. 2), *but* this is sometimes held vertically or even arched over the back. Care should thus be taken when looking for this structure.

2. Males with a pale band on face near mouth (Fig. 69); females with a small dark patch on lower half of sucking pump, above dark markings near mouth (Fig. 80) ..... ***lineatocollis* Stål** (p. 35)
Males with two small pale spots on face near mouth (Fig. 70); females with sucking pump black on upper half (Figs. 76, 78), **or** with sucking pump pale, unmarked above black patch near mouth (Figs. 77, 79) 3
3. Males with sucking pump distinctly projecting before ridge on crown, which connects eyes when viewed from *directly* above (Fig. 60); females with pale band on face near mouth (Figs. 76, 77) ..... ***atrapicata* Hamilton** (p. 35)
Males with sucking pump scarcely projecting before ridge on crown, which connects eyes when viewed from *directly* above (Fig. 61); females with face near mouth entirely black (Figs. 78, 79) ..... ***brunnea* Ball** (p. 36)

Clé des espèce canadiennes du groupe *lineatocollis*

1. Mâles et femelles jaunes; pronotum marqué de 5 à 7 bandes très noires toutes bien distinctes (fig. 65) ..... ***delicata* Uhler** (p. 34)
Mâles noirs (fig. 62); femelles* jaunes, à pronotum rayé de huit fines lignes brunes ou plus, derrière une bande beaucoup plus large et plus foncée le long de l'arête antérieure (fig. 63) 2
2. Mâles arborant une bande pâle sur la face, près de la bouche (fig. 69); femelles arborant une petite tache foncée sur la moitié inférieure de la pompe suceuse, au-dessus de taches foncées situées près de la bouche (fig. 80) ..... ***lineatocollis* Stål** (p. 35)
Mâles arborant deux petites taches pâles sur la face, près de la bouche (fig. 70); femelles avec moitié supérieure de la pompe suceuse noire (fig. 76 et 78), ou pompe suceuse pâle et concolore au-dessus de la tache noire située près de la bouche (fig. 77 et 79) 3
3. Mâles avec pompe suceuse dépassant nettement la crête du vertex, laquelle relie les yeux en vue *surplombante* (fig. 60); femelles avec bande pâle sur la face, près de la bouche (fig. 76 et 77) ..... ***atrapicata* Hamilton** (p. 35)
Mâles avec pompe suceuse dépassant à peine la crête du vertex, laquelle relie les yeux en vue *surplombante* (fig. 61); femelles avec face entièrement noire près de la bouche (fig. 78 et 79) ..... ***brunnea* Ball** (p. 36)

Clastoptera delicata Uhler

Fig. 65

Clastoptera delicata Uhler, 1876:348; Doering 1928:24.

Adults. Distinguished from other species of the *lineatocollis*-group by the yellow males and darker, fewer pronotal lines (Fig. 65). Length: males, 3.6-3.8 mm; females, 4.2-5.1 mm.

*On reconnaît les femelles à leur gros ovipositeur (fig. 2), *toutefois*, ce dernier est souvent en position verticale ou même ramené au-dessus du dos. Il faut donc rechercher avec soin cette structure.

Yellow; fore wings usually either clouded or mottled with brown, marked with bold black bars across crown, pronotum, and sucking pump.

Not yet found in Canada, but found as far north as Wyoming and Oregon. It should be sought in southern British Columbia.

Hosts. Nymphs feed on Stinking rabbitbrush (*Chrysothamnus nauseosus*) and Big sagebrush (*Artemisia tridentata*) (Ball 1927).

Adults feed on the same hosts as the nymphs, and are also reported from Russian-thistle (*Salsola pestifer*) (Doering 1942).

Clastoptera lineatocollis Stål

Figs. 69, 80

Clastoptera lineatocollis Stål, 1854:253; Doering 1928:20.

Adults. Distinguished from *Clastoptera brunnea* and *C. atrapicata*, its close relatives, by the male's pale band across the face (Fig. 69) and by the female's dark patch near the middle of the sucking pump (Fig. 80). Length: males, 3.0-3.2 mm; females, 3.3-3.8 mm.

Color similar to that of *C. atrapicata*, but with different facial markings as described above.

Not yet found in Canada, but found as far north as Utah (Ball 1927). It should be sought in southern British Columbia.

Hosts. Nymphs are unknown.

Adults feed on Big sagebrush (*Artemisia tridentata*), mint (*Mentha* sp.) (Ball 1927), Linear-leaved wormwood (*Artemisia dracunculoides*), Burrowood (*Franseria dumosa*), Stinking rabbitbrush (*Chrysothamnus nauseosus*), and four other broad-leaved herbaceous plants (Doering 1942).

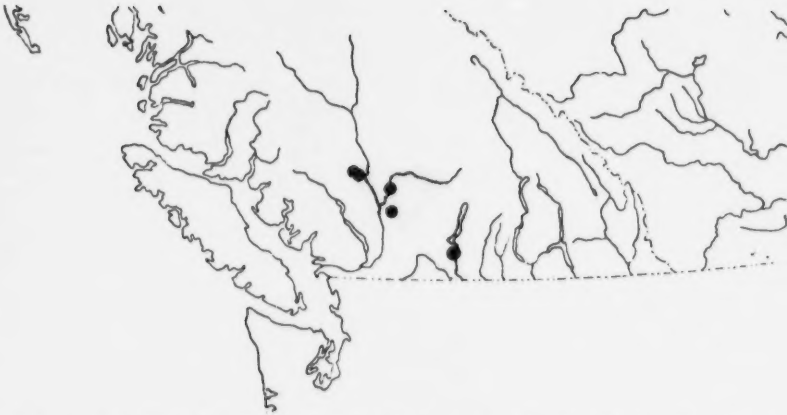
Clastoptera atrapicata Hamilton

Figs. 60, 62, 63, 70, 76, 77; Map 11

Clastoptera atrapicata Hamilton, 1977*b*:38.

Adults. Distinguished from *Clastoptera brunnea*, its close relative, by the male's more inflated sucking pump (Figs. 60, 62) and the female's facial pattern, which is characterized by a black patch near the tip of the head and by a pale band near the mouth (Figs. 76, 77). Length: males, 2.9-3.5 mm; females, 3.2-4.2 mm.

Males black, paler near tips of fore wings (Fig. 62); face black, with two somewhat paler spots near eyes (Fig. 70). Females yellow; fore wings more



Map 11. Collection localities for *Clastoptera atrapicata* Hamilton. Shaded: arid regions with an annual water deficit of 30.5 cm.

or less clouded with pale brown and mottled with dark brown, with one black line across crown and another across front margin of pronotum, followed by numerous brown lines (Fig. 63).

Local, in open arid Ponderosa pine stands of southern British Columbia, south to Oregon (Hamilton 1977*b*).

Hosts. Nymphs are unknown.

Adults feed on Big sagebrush (*Artemisia tridentata*).

Clastoptera brunnea Ball

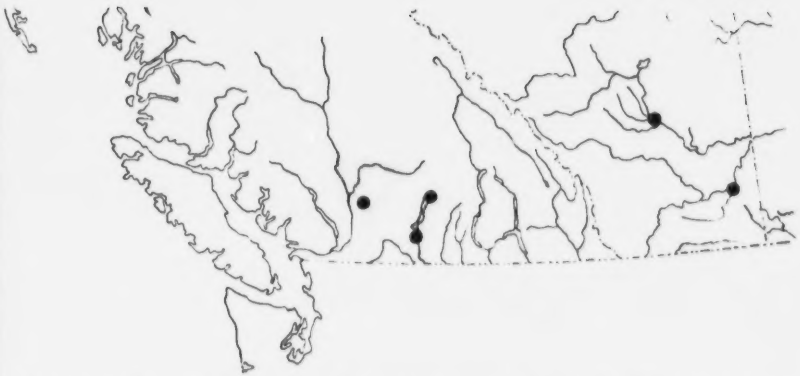
Figs. 61, 63, 64, 70, 78, 79; Map 12

Clastoptera lineatocollis var. *brunnea* Ball, 1919:147.
Clastoptera lineatocollis var. *binotata*: Downes 1924:31 (not Uhler's *binotata*, which inhabits the United States).
Clastoptera brunnea: Doering 1928:26.

Adults. Distinguished from *Clastoptera atrapicata* by the male's less inflated sucking pump (Figs. 61, 64) and the female's facial pattern, which is usually almost entirely black from the tip of the head to the mouth (Fig. 78) and even in the palest forms is solid black near the mouth (Fig. 79). Length: males, 2.8–3.3 mm; females, 3.4–3.9 mm.

Color similar to that of *C. atrapicata*.

Local, on open arid hillsides of southern British Columbia, south to California.



Map 12. Collection localities for *Clastoptera brunnea* Ball. Shaded: arid regions with an annual water deficit of 30.5 cm.

Hosts: Nymphs feed on the tips of Big sagebrush (*Artemisia tridentata*), California mugwort (*Artemisia californica*), Stinking rabbitbrush (*Chrysothamnus nauseosus*), Coyote brush (*Baccharis pilularis*), Mule-fat (*Baccharis viminea*), Gum plant (*Grindelia camporum*) (Severin 1950), and probably many other arid-adapted plants.

Adults feed on Big sagebrush (*Artemisia tridentata*), Hoary sagebush (*A. cana*), Stinking rabbitbrush (*Chrysothamnus nauseosus*), and *Hymenoclea salsola* (a relative of ragweed) (Doering 1942).

Genus *Prosapia* Fennah

Figs. 16, 85

Adults. Distinguished from all other Canadian spittlebug genera by the stout, broadly oval form (Fig. 3), distinctly humped pronotum, hairy face, close-set ocelli separated by a prominent ridge, and dark color (Fig. 16). This genus is closely allied to several tropical genera, including *Tomaspis* Amyot & Serville and *Aeneolamia* Fennah, which can be distinguished reliably only by minutiae of antennal structure and male copulatory apparatus.

Probably one brood per year on various plants.

Prosapia is a genus restricted to North America (including Central America), with many tropical species (Hamilton 1977*a*). Only two of these occur in Canada and the U.S.

Key to Canadian species of *Prosapia*

1. Underside of body black, marked with contrasting bright scarlet patches at bases of hind legs (Fig. 3) ..... ***ignipectus* (Fitch)** (p. 38)
   Underside of body deep crimson, irregularly mottled with black; no contrasting scarlet areas ..... ***bicincta* (Say)** (p. 39)

Clé des espèces canadiennes du genre *Prosapia*

1. Dessous du corps noir, marqué de taches écarlates vives et contrastantes à la base des pattes métathoraciques (fig. 3) ..... ***ignipectus* (Fitch)** (p. 38)
   Dessous du corps rouge cramoisi, moucheté irrégulièrement de noir; pas de zone écarlate contrastante ..... ***bicincta* (Say)** (p. 39)

Prosapia ignipectus (Fitch)

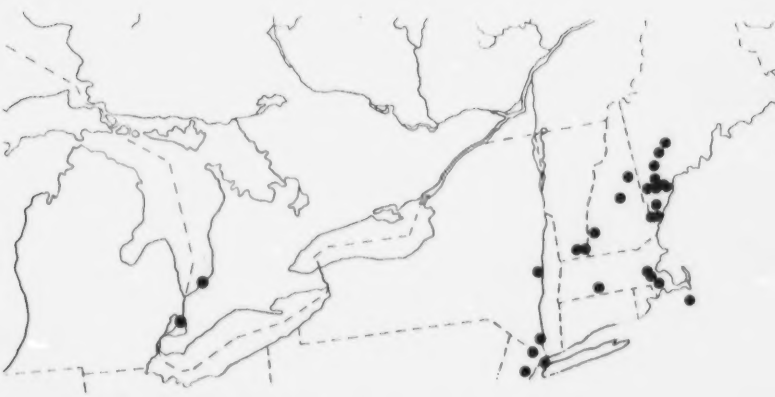
Black spittlebug

Figs. 3, 16, 85; Map 13

Monecphora ignipectus Fitch, 1856:389.
Prosapia ignipectus: Hamilton 1977:626.

Adults. Distinguished from *Prosapia bicincta* by the slightly nar rower form and distinctive color pattern. Length: males, 6.8–8.3 mm females, 7.5–7.9 mm.

Black; underside boldly marked with scarlet on thorax near hind leg bases, and with small scarlet patches on leg bases and leg joints, and on edges of abdominal segments (Fig. 3).



Map 13. Collection localities for *Prosapia ignipectus* (Fitch).

Local, in southernmost Ontario; common in sandy areas of New England, south to southern Pennsylvania (Morse 1921). Most records of "*bicincta*" from the northern U.S. probably refer to *P. ignipectus*.

Hosts. Nymphs feed on the subterranean parts of Little bluestem (*Schizachyrium scoparium*, formerly *Andropogon scoparius*).

Adults feed on Little bluestem (Morse 1921) and probably on other grasses.

Prosapia bicincta (Say)

Twolined spittlebug

Cercopis bicincta Say, 1831:303.
Monecphora bifascia Walker, 1851:679.
Monecphora angusta Walker, 1851:680.
Monecphora basalis Walker, 1851:683.
Monecphora neglecta Walker, 1851:683.
Monecphora fraterna Uhler, 1864:160.
Prosapia bicincta: Hamilton 1977:624.

Adults. Distinguished from *Prosapia ignipectus* by the slightly broader and flatter form and distinctive color pattern. Length: males, 7.9–10.8 mm; females, 7.7–9.8 mm.

Black, mottled with deep crimson on underside, including legs; usually marked with three fine crossbands of yellow, orange, or scarlet on upper side, one on pronotum, and two across fore wings.

Not yet found in Canada. This species is abundant in the southeastern U.S. (Hamilton 1977*a*), ranging north to Pennsylvania, Indiana (Say 1831), Massachusetts, New Jersey, and Maine (Morse 1921). It should be sought (but not expected) in southernmost Ontario.

Hosts. Nymphs feed on the subterranean stems and roots of grasses (Ball 1928).

Adults are general feeders on deciduous trees, bushes, and broad-leaved herbaceous plants as well as grasses. They have been reported on Sugarcane (*Saccharum officinarum*) (Doering 1942), and damaging the foliage of Holly (*Ilex* sp.) (Baker 1972).

Genus *Aphrophora* Germar

Figs. 17–38, 86, 87

Adults. Distinguished from all other genera of Canadian spittlebugs by the prominent pits on the fore wings and by the elongate beak.

A large Northern Hemisphere genus with many Asian species, *Aphrophora* is represented in Canada by 12 native species (Hamilton 1982) and two European species introduced in North America by man (Metcalf and Barber 1929, Moore 1956).

Four subgenera are represented in Canada, which differ in details of body form and in hosts.

Key to Canadian subgenera of *Aphrophora*

1. Sucking pump greatly inflated, globose (Fig. 38) ..... subgenus ***Pinimber*** **Hamilton** (p. 40)
   Sucking pump not globose (Figs. 20, 21) 2
2. Margins of pronotum nearly as long as eye (Figs. 13, 24); pronotum distinctly humped (Fig. 21) ..... subgenus ***Peuceptyelus*** **Sahlberg** (p. 42)
   Margins of pronotum not more than two-thirds as long as eye (Fig. 22); pronotum level (Fig. 20) 3
3. Fore wings more or less shiny, with prominently raised veins (Figs. 17–20). Beak not exceeding bases of hind legs (Fig. 5) ..... subgenus ***Aphrophora*** **Germar** (p. 44)
   Fore wings dull, with veins scarcely raised and usually obscure (Figs. 25–27). Beak exceeding bases of hind legs (Fig. 6) ..... subgenus ***Plesiommata*** **Provancher** (p. 48)

Clé des sous-genres canadiens du genre *Aphrophora*

1. Pompe suceuse très renflée, globulaire (fig. 38) ..... sous-genre ***Pinimber*** **Hamilton** (p. 40)
   Pompe suceuse non globulaire (fig. 20 et 21) 2
2. Bords du pronotum presque aussi longs que l'œil (fig. 13 et 24); pronotum nettement voûté (fig. 21) ..... sous-genre ***Peuceptyelus*** **Sahlberg** (p. 42)
   Bords du pronotum pas plus longs que les deux tiers de l'œil (fig. 22); pronotum plat (fig. 20) 3
3. Ailes antérieures plus ou moins brillantes aux nervures nettement proéminentes (fig. 17 à 20). Bec ne dépassant pas la base des pattes métathoraciques (fig. 5) ..... sous-genre ***Aphrophora*** **Germar** (p. 44)
   Ailes antérieures ternes aux nervures à peine proéminentes et généralement indistinctes (fig. 25 à 27). Bec dépassant la base des pattes métathoraciques (fig. 6) ..... sous-genre ***Plesiommata*** **Provancher** (p. 48)

Aphrophora (*Pinimber*) Hamilton

Figs. 5, 38

Adults. Distinguished from all other subgenera of *Aphrophora* by the greatly inflated globose sucking pump, long, broad head about as wide as the pronotum, and relatively long margins of the pronotum.

One brood per year (Knull 1932) on conifers. Spittle masses exude copious amounts of sap, which fall like rain in infested forests (Knull 1932,

Craighead 1950). Adults also produce sufficient honeydew for this to fall like a mist (Knull 1932) or light rain (Craighead 1950).

Pinimber is a North American subgenus with a single distinctive species.

Aphrophora (*Pinimber*) *cribrata* (Walker)

Pine spittlebug

Figs. 5, 38; Map 14

Ptyelus cribrata Walker, 1851:712.
Aphrophora parallela: Walley 1928:186, et al. (not Say's *parallella*; see *Aphrophora* (*Plesiommata*) *parallella*).
Aphrophora cribrata: Hamilton, 1982:1186.

Adults. Distinguished from other species of *Aphrophora* by the long crown, globose sucking pump, and black-barred veins of the fore wings (Fig. 38). Length: males, 8.8–10.8 mm; females, 9.1–11.5 mm.

Brown, heavily overlaid with black spots and streaks, and varied with irregular whitish blotches on fore wings (Fig. 36); rarely solid blackish brown.

Locally abundant in white pine woods of Eastern Canada, rarer on other pines west to Saskatchewan, south to Georgia. Severe local infestations may occur in the east every 9 years (Craighead 1950).

Map 14. Collection localities for *Aphrophora* (*Pinimber*) *cribata* (Walker). Shaded: distribution of White pine.

Hosts. Nymphs feed on the tips of branches of various pines, moving to the trunk as they mature (Knull 1932, Craighead 1950). The preferred host is the introduced Scots pine (*Pinus sylvestris*) (Baker 1972); the preferred native hosts are Pitch pine (*P. rigida*) and White pine (*P. strobus*) (Speers 1941). Norway spruce (*Picea abies*) planted among pines may also be attacked by the nymphs (Walden 1917). Records of "*Aphrophora parallela*" feeding on pines refer to *cribrata*.

Adults feed on the same hosts as the nymphs; they have also been reported from Canadian hemlock (*Tsuga canadensis*) (Van Duzee 1894), Balsam fir (*Abies balsamea*), and various species of spruce (*Picea* spp.) (Baker 1972), but these are probably strays from pines. The feeding punctures are frequently invaded by Scotch pine blight (*Sphaeropsis ellisii*) or sooty mold, causing dieback and eventual death of the tree (Speers 1941, Craighead 1950). Native trees are apparently more resistant to damage by the feeding of this insect than are Scots pines (Speers 1941).

Aphrophora (*Peuceptyelus*) Sahlberg

Figs. 21, 23, 24

Adults. Distinguished from other subgenera of *Aphrophora* by the short, narrow head, which is distinctly narrower than the pronotum, and by the humped pronotum with relatively long margins.

One brood per year on pines (Emeljanov 1964).

Peuceptyelus is a moderately large subgenus well represented in Asia, with a single European species and two North American species, both of which occur in Canada (Hamilton 1982).

Key to Canadian species of *Aphrophora* subgenus *Peuceptyelus*

1. Head distinctly angled (Fig. 23). Color dark brown.. ***princeps*** **Walley** (p. 43)
   Head broadly rounded (Fig. 24). Color pale brown.. ***regina*** **Hamilton** (p. 43)

Clé des espèces canadiennes du genre *Aphrophora*, sous-genre *Peuceptyelus*

1. Tête nettement angulaire (fig. 23). Corps brun foncé ..... ***princeps*** **Walley** (p. 43)
   Tête largement arrondie (fig. 24). Corps brun pâle ..... ***regina*** **Hamilton** (p. 43)

Aphrophora (Peuceptyelus) princeps Walley

Figs. 21, 23; Map 15

Aphrophora princeps Walley, 1928:188.

Adults. Distinguished from *Aphrophora (Peuceptyelus) regina* by the darker color and distinctly angled head. Length: males, 7.8–9.1 mm; females, 9.2 mm.

Red brown; pronotum paler; fore wings with narrow gray lines forming a chevron near middle, and with transverse line toward the tips (as in Fig. 28*a*).

Local, in coastal regions of southern Vancouver Island and adjacent islands in Straight of Georgia, north to Bella Coola, south in coastal regions to northern California (Doering 1941).

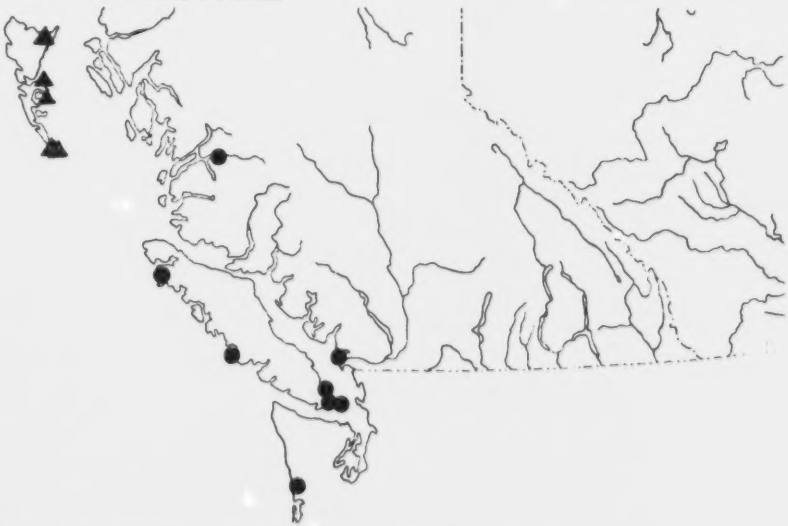
Hosts. Unknown.

Aphrophora (Peuceptyelus) regina Hamilton

Fig. 24; Map 15

Aphrophora regina Hamilton, 1982:1189.

Adults. Distinguished from *Aphrophora (Peuceptyelus) princeps* (Fig. 21) by the lighter color and evenly rounded head. Length: males, 8.7–8.8 mm; females, 9.7 mm.



Map 15. Collection localities for *Aphrophora (Peuceptyelus) regina* Hamilton (▲) and *A. (P.) princeps* Walley (●).

Ochre brown; pronotum paler; fore wings marked as in *princeps*.

Local in the Queen Charlotte Islands.

Hosts. Unknown.

Aphrophora (*Aphrophora*) Germar

Figs. 17-20, 22

Adults. Distinguished from other subgenera of *Aphrophora* by the short, broad head at least as wide as the pronotum, by the relatively short margins of the pronotum, and by the shiny fore wings with prominent veins.

One brood per year (Metcalf and Barber 1929, Ossiannilsson 1950) on broad-leaved herbaceous plants.

Aphrophora is a large subgenus of mainly Old World species, represented in Canada by two native species and an introduced European species (Hamilton 1982); another introduced European species occurs in the New England States and may eventually be found in Canada. One other included species, *angulata* Ball, is apparently restricted to California (Doering 1930).

Key to Canadian species of *Aphrophora* subgenus *Aphrophora*

1. Head distinctly pointed. Fore wings unmarked (Fig. 20) ..... ***salicis* (De Geer)** (p. 45)
   Head broadly rounded. Fore wings marked with pale spots on outer edges (Fig. 17) 2
2. Pronotal margins long. Head about as wide as pronotum (Fig. 22). Inhabiting coastal British Columbia ..... ***ampliata* Hamilton** (p. 45)
   Pronotal margins short. Head distinctly wider than pronotum (Fig. 31). Inhabiting Eastern Canada 3
3. Head distinctly longer at middle than its length near eyes. Fore wings widest at midlength (Fig. 17). Male plates separated by broad, square notch ..... ***quadrinotata* Say** (p. 46)
   Head scarcely longer at middle than its length near eyes. Fore wings widest before midlength (Fig. 18). Male plates appressed to tips ..... ***alni* (Fallén)** (p. 47)

Clé des espèces canadiennes du genre *Aphrophora*, sous-genre *Aphrophora*

1. Tête nettement pointue. Ailes antérieures concolores (fig. 20) ..... ***salicis* (De Geer)** (p. 45)

Tête largement arrondie. Ailes antérieures marquées de taches pâles sur les bords extérieurs (fig. 17) 2

2. Bords du pronotum longs. Tête à peu près aussi large que le pronotum (fig. 22). Habite les côtes de la Colombie-Britannique ... ***ampliata*** **Hamilton** (p. 45)
Bords du pronotum courts. Tête nettement plus large que le pronotum (fig. 31). Habite l'est du Canada 3

3. Tête nettement plus longue au milieu qu'au niveau des yeux. Ailes antérieures plus larges à mi-longueur (fig. 17). Plaques génitales du mâle séparées par une encoche large et carrée ..... ***quadrinotata*** **Say** (p. 46)
Tête à peine plus longue au milieu qu'au niveau des yeux. Ailes antérieures plus larges avant la mi-longueur (fig. 18). Plaques génitales du mâle accolées aux extrémités ..... ***alni*** **(Fallén)** (p. 47)

Aphrophora (*Aphrophora*) *salicis* (De Geer)

Fig. 19

Aphrophora salicis De Geer, 1773:180; Doering 1941:123.

Adults. Distinguished from other species of Canadian *Aphrophora* by the pointed head and even color. Length: males, 9.0–10.0 mm; females, 9.4–11.2 mm.

Tawny, unmarked, except for a tiny pale spot near center of each fore wing.

Not yet found in Canada. This species is frequently abundant in the New England States (Craighead 1950) where it was introduced from Europe prior to 1921 (Metcalf and Barber 1929). It has spread slowly, and should be sought in southern Quebec and the Maritime Provinces.

Hosts. Nymphs feed on the twigs of both native and introduced willows (*Salix* spp.), constructing large spittle masses that drip (Metcalf and Barber 1929).

Adults feed on the same hosts as the nymphs (Metcalf and Barber 1929).

Aphrophora (*Aphrophora*) *ampliata* Hamilton

Figs. 21, 24; Map 16

Aphrophora ampliata Hamilton, 1982:1185.

Adults. Distinguished from the similar *Aphrophora* (*Aphrophora*) *alni* by the head being about the same width as the pronotum, by the longer margins of the pronotum, and by the more broadly expanded fore wing bases. The shape of the fore wings immediately distinguishes this species from all other Canadian spittlebugs. Length: males, 9.8 mm; females, 9.5 mm.

Map 16. Collection localities for *Aphrophora (A.) ampliata* Hamilton.

Pale tawny, except for center of crown and a patch on center of outer edge of each fore wing, which are darker.

Rare; taken at Victoria, on the southern end of Vancouver Island (Map 12), and also recorded from the coast of Washington State as "*Aphrophora angulata*" (Doering 1941).

Hosts. Unknown.

Aphrophora (Aphrophora) quadrinotata Say

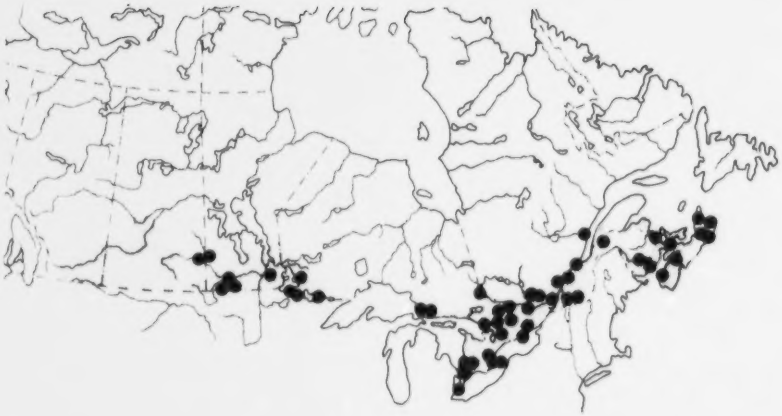
Four-spotted spittlebug

Fig. 17; Map 17

Aphrophora quadrinotata Say, 1831:304; Walley 1928:186.
Aphrophora fascialis Walker, 1858:93.
Aphrophora binotata: Ball 1915:365 (not Uhler's *binotata*, which is a species of *Clastoptera*).
Aphrophora quadrinotata var. *obliterata* Froeschner, 1946:33.

Adults. Distinguished from other Canadian *Aphrophora* by the small size, flattened head, and evenly curved outer edges of the fore wings. Males can also be identified by their plates, which are separated by a square notch (Doering 1930). Length: males, 6.1–8.0 mm; females, 6.8–9.1 mm.

Brown, mottled beneath, fore wings darker with two contrasting pale areas on each outer edge; occasionally dark brown with pale eyes, and only two slightly paler areas at the midlength of each fore wing.



Map 17. Collection localities for *Aphrophora (A.) quadrinotata* Say. Shaded: region of summer temperatures (above 5.5°C) of more than 1400 degree-days per year.

Locally common in eastern U.S. and southeastern Canada, west to Manitoba.

Hosts. Nymphs feed on the aerial parts of grape vines (*Vitis* sp.), grasses, and other herbaceous plants (Doering 1942).

Adults have been taken on grape vines (Fitch 1851), Blackberry (*Rubus hispidus*) (Knull 1932), oaks (*Quercus* spp.), poplar (*Populus* sp.), Beaked hazelnut (*Corylus cornuta*), Speckled alder (*Alnus rugosa*), and various broad-leaved herbaceous plants.

Aphrophora (Aphrophora) alni (Fallén)

European alder spittlebug

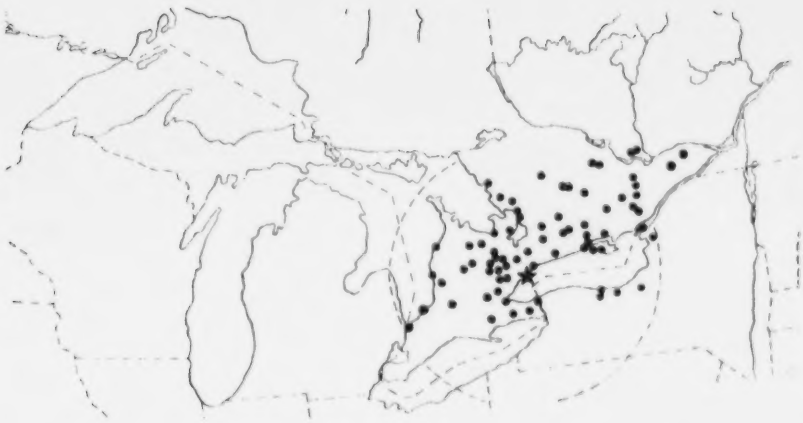
Fig. 18; Map 18

Cercopis alni Fallén, 1805:240.

Adults. Distinguished from *Aphrophora (A.) quadrinotata* by the large size, thick blunt head, and the fore wings being curved most strongly near the base. Length: 8.4–9.6 mm; females, 8.9–10.0 mm.

Brown, marked with two pale areas on outer edge of each fore wing.

Abundant in southern Ontario, usually within 260 km radius of Toronto. Probably introduced by man from Europe; first recorded on this continent from Toronto, Ont. on 6 August 1927, but not common until 1952 (Moore 1956).



Map 18. Collection localities for *Aphrophora (A.) alni* (Fallén). Shaded circle: 260 km radius from Toronto, the presumptive port of entry (star).

Hosts. Nymphs feed on root crowns of numerous broad-leaved herbaceous plants, and on the adventitious shoots of willows (*Salix* spp.), birch (*Betula* sp.), and alders (*Alnus* sp.) (Ossiannilsson 1950).

Adults feed on alders (*Alnus* spp.), willows (*Salix* spp.), and to a lesser extent, on other deciduous trees, bushes, and broad-leaved herbaceous plants (Ossiannilsson 1950). The adults are active and may be found on many plants in the neighborhood of alder thickets.

Aphrophora (*Plesiommata*) Provancher

Figs. 6, 25–37, 86

Adults. Distinguished from other subgenera of *Aphrophora* by the combination of head at least as wide as pronotum, very short margins of the pronotum, and very long beak that extends beyond the bases of the hind legs.

One brood per year (Anderson 1947*b*), the nymphs (except those of *A. canadensis*) feeding on broad-leaved herbaceous plants as do those of the subgenus *Aphrophora*, while the adults feed on conifers, as do those of the subgenera *Pinimber* and *Peuceptyelus*.

Plesiommata is a moderately large genus well represented both in Asia and North America, and with a single European species (Hamilton 1982). There are seven included species in Canada, and an additional four in the southwestern United States: *annulata* Ball, *irrorata* Ball, *punctipes* Walley, and an unnamed species allied to *canadensis* (Doering 1941).

Females of the four closely related species *signoretii* Fitch, *permutata* Uhler, *fulva* Doering, and *maculosa* Doering usually cannot be identified unless associated with males.

Key to Canadian species of *Aphrophora* subgenus *Plesiommata*

1. Crown with a broad white or yellow stripe down middle (Figs. 25, 26, 30) 7
   Crown without more than a fine pale line down middle (Figs. 27, 28, 31)... 2
2. Sucking pump weakly inflated, face thus scarcely visible from above. Fore wings evenly colored, or variegated with paler lines (Fig. 26) 6
   Sucking pump strongly inflated, face thus clearly visible from above (Fig. 27). Fore wings usually variegated with darker lines or a broad pale patch (Figs. 27, 28a–g) 3
3. Male plates divergent (Fig. 32). Inhabiting boreal zone (Map 19) ..... ***gelida* (Walker)** (p. 50)
   Male plates appressed to tips (Fig. 33). Inhabiting southern British Columbia and foothills of Alberta (Maps 20–22) 4
4. Male plates shorter than abdominal segment to which they are attached (Fig. 37) ..... ***maculosa* Doering** (p. 51)
   Male plates longer than abdominal segment to which they are attached (Figs. 35, 36) 5
5. Male plates strongly tapered, less than half as wide at tip as at base (Fig. 35) ..... ***fulva* Doering** (p. 52)
   Male plates scarcely tapered, about two-thirds as wide at tip as at base (Fig. 36) ..... ***permutata* Uhler** (p. 53)
6. Crown more than half as long as pronotum (Fig. 31). Inhabiting Pacific coast of British Columbia ..... ***canadensis* Walley** (p. 54)
   Crown less than half as long as pronotum (Fig. 29). Inhabiting Eastern Canada ..... ***saratogensis* (Fitch)**, variety (p. 57)
7. Male plates each less than one and a half times as long as broad. Color usually blackish brown (sometimes orange brown). Hosts: spruce (*Picea* spp.) and Tamarack (*Larix laricina*) ..... ***parallella* (Say)** (p. 55)
   Male plates each more than one and a half times as long as broad. Color usually orange (sometimes orange brown). Hosts: pine (*Pinus* spp.) ..... ***saratogensis* (Fitch)**, usual form (p. 57)

Clé des espèces canadiennes du genre *Aphrophora*, sous-genre *Plesiommata*

1. Vertex marqué au centre d'une large bande blanche ou jaune (fig. 25, 26 et 30) 7
   Vertex marqué au centre de pas plus d'une ligne fine et pâle (fig. 27, 28 et 31) 2

2. Pompe suceuse peu renflée; face ainsi à peine visible en vue dorso-latérale. Ailes antérieures de couleur uniforme ou panachées de lignes plus pâles (fig. 26) 6
Pompe suceuse très renflée, face ainsi nettement visible en vue dorso-latérale (fig. 27). Ailes antérieures généralement panachées de lignes plus foncées ou marquées d'une large tache pâle (fig. 27 et 28*a*–*g*) 3
3. Plaques génitales du mâle divergentes (fig. 32). Habite la zone boréale (carte 19) ..... ***gelida* (Walker)** (p. 50)
Plaques génitales du mâle accolées aux extrémités (fig. 33). Habite le sud de la Colombie-Britannique et les avant-monts de l'Alberta (cartes 20 à 22) 4
4. Plaques génitales du mâle plus courtes que le sternite abdominal auquel elles se rattachent (fig. 37) ..... ***maculosa* Dœring** (p. 51)
Plaques génitales du mâle plus longues que le sternite abdominal auquel elles se rattachent (fig. 35 et 36) 5
5. Plaques génitales du mâle très fuselées; largeur à l'extrémité égale à moins de la moitié de celle à la base (fig. 35) ..... ***fulva* Dœring** (p. 52)
Plaques génitales du mâle à peine fuselées; largeur à l'extrémité égale aux deux tiers environ de celle à la base (fig. 36) ..... ***permutata* Uhler** (p. 53)
6. Vertex plus long que la moitié du pronotum (fig. 31). Habite la côte de la Colombie-Britannique ..... ***canadensis* Walley** (p. 54)
Vertex moins long que la moitié du pronotum (fig. 29). Habite l'est du Canada ..... ***saratogensis* (Fitch)**, variété (p. 57)
7. Chacune des plaques génitales du mâle moins d'une fois et demie plus longue que large. Généralement brun noirâtre (quelquefois brun orangé). Hôtes: épinette (*Picea* spp.) et mélèze (*Larix laricina*) ..... ***parallella* (Say)** (p. 55)
Chacune des plaques génitales du mâle plus d'une fois et demie plus longue que large. Généralement orangé (quelquefois brun orangé). Hôte: pin (*Pinus* spp.) ..... ***saratogensis* (Fitch)**, forme habituelle (p. 57)

Aphrophora (*Plesiommata*) *gelida* (Walker)

Boreal spittlebug

Figs. 6, 27, 28, 32; Map 19

Ptyelus gelidus Walker, 1851:714.
Aphrophora signoretii Fitch, 1856:388.
Aphrophora annulata: Essig 1926:203; Strickland 1953:203 (not Ball's *annulata*, which inhabits U.S.).

Adults. Distinguished in the males from other Canadian species of the subgenus *Plesiommata* by the divergent fingerlike plates (Fig. 32). Females can be distinguished only by the range of this species; association with males will also help identify them. Length: males, 8.5–10.0 mm; females, 9.2–10.8 mm.

Color variable, from ochre yellow to dark brown, more or less patterned in light and dark, sometimes with a contrasting yellow patch on middle of fore wings, or with pronotum pale (Fig. 28*a*–g).

Map 19. Collection localities for *Aphrophora (Plesiommata) gelida* (Walker). Shaded: region of summer temperatures (above 5.5°C) of more than 800 degree-days per year.

Locally common in the boreal zone across Canada, from central British Columbia to the Atlantic, south in the Appalachian Mountains to North Carolina (Ball 1928).

Hosts. Nymphs feed on the aerial parts of various broad-leaved herbaceous plants including grape vines (*Vitis* sp.) (Knull 1932), goldenrod (*Solidago* sp.), and Fireweed (*Epilobium angustifolium*). The heavy spittle masses are supported by the leaf axils.

Adults are apparently general feeders on conifers: on pines (*Pinus banksiana* and *P. contorta*), spruces (*Picea engelmannii, P. glauca,* and *P. mariana*), Tamarack (*Larix laricina*), and Douglas-fir (*Pseudotsuga menziesii*). There are also a few records from birch (*Betula* sp.), willow (*Salix* sp.), and poplar (*Populus* sp.), but these are probably strays from conifers.

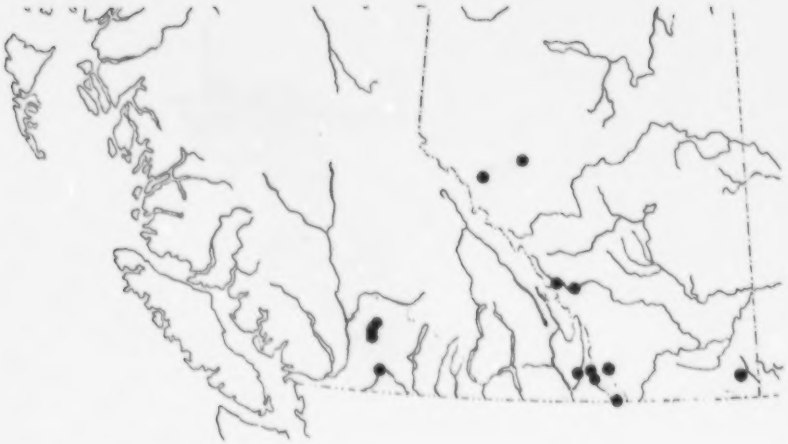
Aphrophora (Plesiommata) maculosa Doering

Figs. 28, 37; Map 20

Aphrophora maculosa Doering, 1941:128.
Aphrophora permutata: Strickland 1953:203 (not Uhler's *permutata*; see below).

Adults. Distinguished from other species of *Aphrophora* by the shape of the male plates (see key) and details of the internal male genitalia (Hamilton 1982). *A. maculosa* closely resembles *A. gelida* (Fig. 27) in body form. Length: males, 8.9–10.5 mm; females, 10.4–11.8 mm.

Color variable, as in *gelida* (Fig. 28*a–g*).



Map 20. Collection localities for *Aphrophora (Plesiommata) maculosa* Doering. Shaded: region of Lodgepole pine forests at low elevation (omitting range of Shore pine, usually regarded as a subspecies of Lodgepole pine).

Locally common in Lodgepole pine woods in the Cypress Hills and on the foothills and Rocky Mountains of Alberta and southern British Columbia south to California (Doering 1941).

Hosts. Nymphs are unknown; they are probably subterranean, like those of *Aphrophora fulva*.

Adults have been taken on Lodgepole pine (*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*).

Aphrophora (Plesiommata) fulva Doering

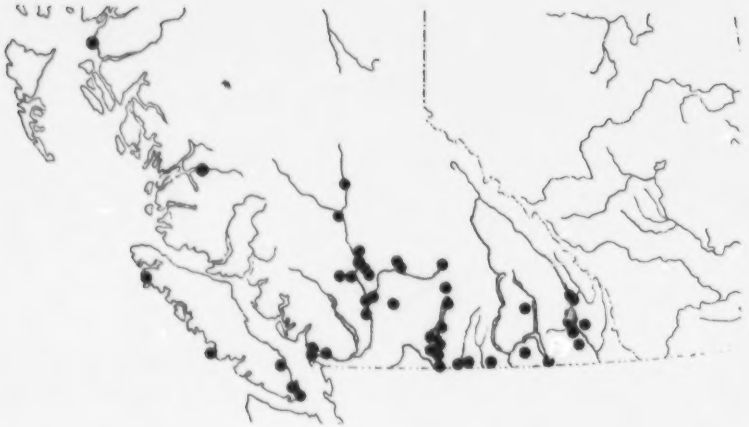
Western pine spittlebug

Figs. 28, 35; Map 21

Aphrophora fulva Doering, 1941:127.

Aphrophora permutata: Doering 1942:121; DeLong and Severin 1950:339; Severin 1950:360; Kelson 1964:139 (not Uhler's *permutata*; see next species).

Adults. Distinguished from other species of *Aphrophora* by the shape of the male plates (see key) and details of the internal male genitalia (Hamilton 1982). *A. permutata* closely resembles *A. gelida* (Fig. 27) in body form. Length: males, 8.2–11.2 mm; females, 9.9–12.2 mm.



Map 21. Collection localities for *Aphrophora (Plesiommata) fulva* Doering. Shaded: region of summer temperatures (above 5.5°C) of more than 1400 degree-days per year.

Color variable, as in *gelida* (Figs. 26*a*–*g*).

Common in Shore pine and Lodgepole pine woods in warm areas of southern British Columbia south to California (Doering 1941).

Hosts. Nymphs feed on the subterranean stems and roots of lupine (*Lupinus* sp.), Hairy golden aster (*Chrysopsis villosa*) (Ball 1901), Bristly ox-tongue (*Picris echioides*) (Kelson 1964), and 29 other broad-leaved herbaceous plants (DeLong and Severin 1950). The last two instars may feed on the aerial parts of the hosts (Kelson 1964). A "second generation" reported from California on pines (Severin 1950) refers to an unnamed species of *Aphrophora*.

Adults feed on Monterey pine (*Pinus radiata*), Shore or Lodgepole pine (*P. contorta*) (Kelson 1964), and probably also Ponderosa pine (*P. ponderosa*). There are also a few records from Douglas-fir (*Pseudotsuga menziesii*) but these are probably strays from pines, because no long series of *fulva* has been taken on this host.

Aphrophora (Plesiommata) permutata Uhler

Douglas-fir spittlebug

Figs. 28, 36; Map 22

Aphrophora permutata Uhler, 1872:472; Walley 1928:188.

Map 22. Collection localities for *Aphrophora (Plesiommata) permutata* Uhler. Shaded: region of Douglas-fir forests at low elevations.

Adults. Distinguished from other species of *Aphrophora* by the shape of the male plates (see key) and details of the internal male genitalia (Hamilton 1982). *A. permutata* closely resembles *A. gelida* (Fig. 27) in body form. Length: males, 8.2–11.2 mm; females, 9.9–12.2 mm.

Color variable, as in *A. gelida* (Figs. 28*a–g*).

Common in forests where Douglas-fir is dominant in southern British Columbia south to California (Doering 1941).

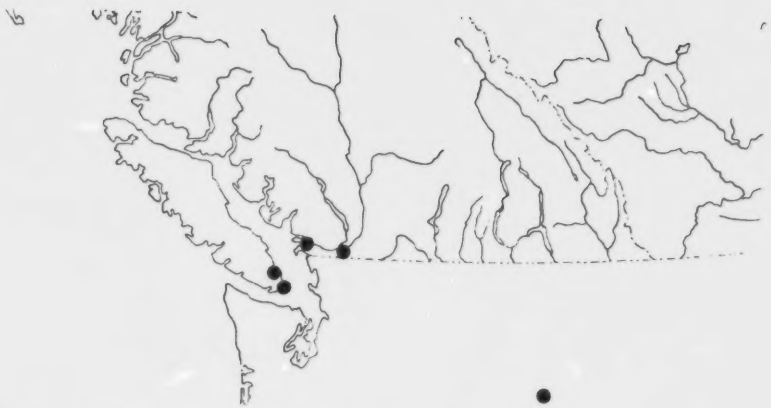
Hosts. Nymphs have been recorded damaging the leaves of Pacific Coast red elder (*Sambucus callicarpa*) (Doering 1942). Records from other hosts apparently refer to *Aphrophora fulva* rather than to *permutata*.

Adults feed on Douglas-fir (*Pseudotsuga menziesii*), the preferred host, on Grand fir (*Abies grandis*) (Doane et al. 1936), and possibly on Sitka spruce (*Picea sitchensis*). There are also a few records from the nymphal host (Doering 1942), Lodgepole pine (*Pinus contorta*), Western white pine (*Pinus monticola*), and Western larch (*Larix occidentalis*), but these are probably strays from Douglas-fir, because no long series of *permutata* has been taken on these hosts.

Aphrophora (Plesiommata) canadensis Walley

Fig. 31; Map 23

Aphrophora canadensis Walley, 1928:190.



Map 23. Collection localities for *Aphrophora (Plesiommata) canadensis* Walley.

Adults. Distinguished from other species of the subgenus *Plesiommata* by the long crown and by the head being wider than the pronotum. This species has been confused with an unnamed species of *Aphrophora* (Doering 1941), but is readily distinguishable, as the head of the latter is distinctly narrower than the pronotum. *A. canadensis* most closely resembles *A. saratogensis* (Fig. 26) in body form. Length: males, 8.1–8.8 mm; females, 8.8–9.6 mm.

Orange brown; crown and pronotum usually darker, marked with a narrow, often indefinite whitish line forming a chevron across middle of fore wings, and usually crossing an indefinite brown V-shaped mark.

Local, in coastal British Columbia; also taken at Moscow, Idaho, probably introduced on Mugho pine (*Pinus mugo*).

Hosts. Nymphs and adults feed on Mugho pine (*Pinus mugo*) and possibly also on other pines.

Aphrophora (Plesiommata) parallella (Say)

Spruce spittlebug

Figs. 25, 30; Map 24

Cercopis parallella Say, 1824:303.
Aphrophora parallella: Hamilton 1982:1188.

Adults. Distinguished from other species in the subgenus *Plesiommata* by the small size and dark color. Light-colored specimens may be difficult to distinguish from dark-colored specimens of *Aphrophora* (*P.*)

Map 24. Collection localities for *Aphrophora (Plesiommata) parallella* (Say). Shaded: region of mixed coniferous–deciduous forests.

saratogensis, but usually have the pale stripe on the head bordered with dark brown. Length: males, 7.0–9.4 mm; females, 8.0–10.0 mm.

Blackish brown, usually mottled with brown and gray, marked with a broad white or yellow stripe down middle of crown, which usually extends onto front half of pronotum (Fig. 25); scutellum and sometimes half or all of pronotum may be contrastingly yellow. Occasional light-colored forms are found that are mottled orange brown with the fore wings marked with two gray chevrons, and with the yellow stripe on the crown usually bordered with dark brown.

Locally common in mixed spruce-maple woods from Manitoba to Nova Scotia, south in the Appalachian Mountains to South Carolina.

Hosts. Nymphs are unknown; they are probably subterranean, like those of the closely related *saratogensis*.

Adults prefer White spruce (*Picea glauca*) and Red spruce (*Picea rubens*) but also feed on Black spruce (*Picea mariana*) and Tamarack, or Eastern larch, (*Larix laricina*). A few specimens have also been taken on Jack pine (*Pinus banksiana*), Balsam fir (*Abies balsamea*), and Common ground juniper (*Juniperus communis*), but these are probably strays from spruce.

Aphrophora (Plesiommata) saratogensis (Fitch)

Saratoga spittlebug

Figs. 26, 29; Map 25

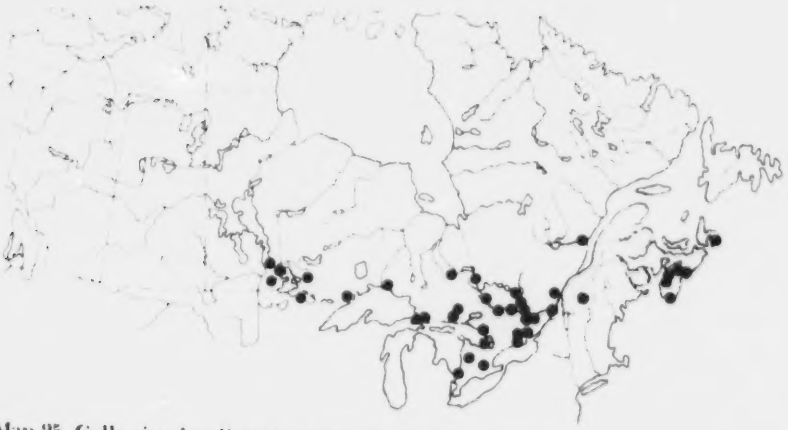
Lepyronia saratogensis Fitch, 1851:53.
Ptyelus detritus Walker, 1851:713.
Plesiommata biundulata Provancher, 1890:264A.
Aphrophora saratogensis: Walley 1928:189.

Adults. Distinguished from other species of the subgenus *Plesiommata* by the orange color. Occasional specimens of a darker hue are encountered that may resemble paler specimens of *Aphrophora (P.) parallella*. Length: males, 7.9–10.8 mm; females, 9.0–11.2 mm.

Orange; fore wings slightly brownish, usually marked with a white or yellow stripe down middle of crown and pronotum, and one or two indefinite grayish white curving lines across fore wings, the first forming a chevron, the second a straight line (as in Fig. 28*a*). Some specimens are darker: orange brown, marked with the yellow stripe and grayish white lines described above.

Common in mixed pine-maple forests from Manitoba east to Nova Scotia, south to Florida and Mississippi (Doering 1930).

Hosts. Nymphs feed at or below ground level on the lower stems of Sweet-fern (*Comptonia peregrina*), their preferred host (Ball 1928, Anderson 1947*b*). They will also feed on 23 other hosts, including broad-leaved herbaceous plants, bushes, and tree seedlings (Anderson 1947*b*).



Map 25. Collection localities for *Aphrophora (Plesiommata) saratogensis* (Fitch). Shaded: region of mixed coniferous–deciduous forests.

Adults prefer Red pine (*Pinus resinosa*) and Jack pine (*Pinus banksiana*) but also feed on Eastern white pine (*Pinus strobus*) and Pitch pine (*Pinus rigida*) (Anderson 1947*b*). Adult feeding causes dieback, or flagging, on pines and may eventually kill the tree (Anderson 1947*a*). Records of *A. saratogensis* feeding on Tamarack (*Larix laricina*) (Doering 1941) and Balsam fir (*Abies balsamea*) (Baker 1972) apparently refer to *Aphrophora parallella* rather than to *saratogensis*.

Genus *Lepyronia* Amyot & Serville

Figs. 39–41

Adults. Distinguished from other North American spittlebugs by their wings: the hind wings either have a distinct fold near the tips where they cross each other, or else they are small and flightless, in which case the fore wings are very convex (Figs. 40, 41).

One brood per year (Doering 1922) on various plants.

Lepyronia is a Northern Hemisphere genus with four native North American species, one of which is restricted to Mexico: *L. sordida* Stål. One European species has been introduced into North America by man.

Two subgenera of *Lepyronia* are known (Hamilton 1982), both of which are represented in the Canadian fauna. They are distinguished only by the shape and venation of the wings.

Key to Canadian species of *Lepyronia*

1. Fore wings nearly flat, more than twice as long as wide (Fig. 39) ..... (subgenus *Euclovia*) ***quadrangularis* (Say)** (p. 59)
   Fore wings distinctly convex, twice as long as wide (Figs. 40, 41) ..... (subgenus *Lepyronia*) 2
2. Head rounded at tip (Fig. 41) ..... ***coleoptrata* (Linnaeus)** (p. 60)
   Head pointed at tip (Fig. 40) 3
3. Sucking pump strongly inflated, face thus clearly visible from above (Fig. 40). Inhabiting the Great Plains ..... ***gibbosa* Ball** (p. 61)
   Sucking pump weakly inflated, face thus scarcely visible from above (as in Fig. 39). Inhabiting eastern North America ..... ***angulifera* Uhler** (p. 62)

Clé des espèces canadiennes du genre *Lepyronia*

1. Ailes antérieures presque plates et plus de deux fois plus longues que larges (fig. 39) ..... (sous-genre *Euclovia*) ***quadrangularis* (Say)** (p. 59)
   Ailes antérieures nettement convexes et deux fois plus longues que larges (fig. 40 et 41) ..... (sous-genre *Lepyronia*) 2

2. Tête à l'extrémité arrondie (fig. 11)..... ***coleoptrata*** **(Linnæus)** (p. 60)
Tête à l'extrémité pointue (fig. 40)..... 3
3. Pompe suceuse très renflée; face ainsi nettement visible en vue dorso-latérale (fig. 40). Habite les Prairies ..... ***gibbosa*** **Ball** (p. 61)
Pompe suceuse peu renflée; face ainsi à peine visible en vue dorso-latérale (comme dans la figure 39). Habite l'est de l'Amérique du Nord..... ***angulifera*** **Uhler** (p. 62)

Lepyronia (*Euclovia*) *quadrangularis* (Say)

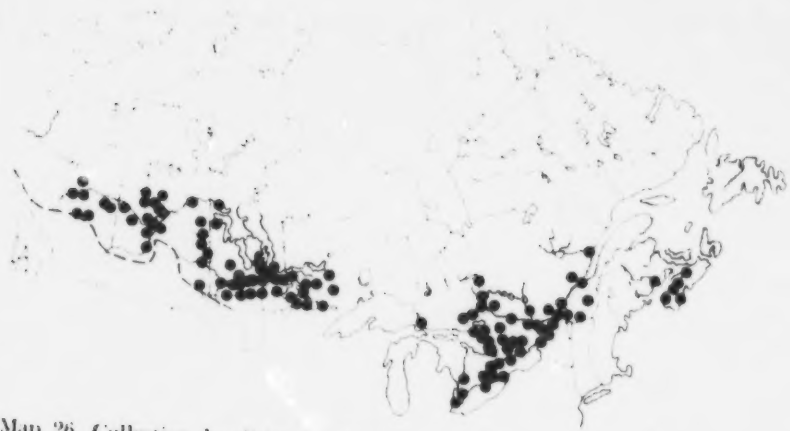
Diamond-backed spittlebug

Fig. 39; Map 26

Cercopis quadrangularis Say, 1825:338.
Lepyronia quadrangularis: Doering 1930:89.

Adults. Distinguished from other species of *Lepyronia* by the fore wings being longer and straighter, sucking pump scarcely inflated, and crown level, giving this insect a flattened appearance when compared to its more robust relatives. Length: males, 5.8–7.2 mm; females, 6.6–8.5 mm.

Tawny, orange brown, or chocolate brown, overlain with a blackish brown diamond-shaped or nearly triangular outline on fore wings, and with dark brown patches at base of each fore wing.



Map 26. Collection localities for *Lepyronia (Euclovia) quadrangularis* (Say). Dotted line: southern edge of forests (as defined by distribution of alder). Shaded: region of forests with summer temperatures (above 5.5°C) of more than 1100 degree-days per year.

Locally abundant in weedy areas near woodlands throughout temperate North America east of the Rocky Mountains (Doering 1922).

Hosts. Nymphs feed on the aerial parts of many different plants, including trees, broad-leaved herbaceous plants, brambles, and grasses; 60 different hosts are recorded for this species (Doering 1942), and this is probably a partial list.

Adults feed on the same hosts as the nymphs (Doering 1922).

Lepyronia (Lepyronia) coleoptrata (Linnaeus)

Figs. 41, 88; Map 27

Cicada coleoptrata Linnaeus, 1758:437.
Lepyronia coleoptrata: Doering 1930:89.

Adults. Distinguished from native North American species of *Lepyronia* by the rounded head. The hind wings are usually short. Length: males, 5.3–6.1 mm; females 6.4–7.9 mm.

Tawny; fore wings usually overlain with dark brown V-shaped marks, these together forming a diamond-shaped or triangular outline; front part of triangle sometimes incomplete or absent, leaving only a transverse band across tips of fore wings; triangle sometimes completely dark and not a mere outline.

Locally abundant in southern Ontario, southern Quebec, Vermont, Pennsylvania, and New York State. This European species was first

Map 27. Collection localities for *Lepyronia (L.) coleoptrata* (Linnaeus). Shaded circle: 180 km radius from Dolceville, N.Y.; star: first recorded North American locality for this species.

collected in North America at Cold Brook, N.Y. in 1940 and is apparently slowly spreading northward.

Hosts. Nymphs feed on the aerial parts of numerous species of trees, broad-leaved herbaceous plants, and grasses (Ossiannilsson 1950).

Adults feed on the same hosts as the nymphs (Ossiannilsson 1950).

Lepyronia (*Lepyronia*) *gibbosa* Ball

Fig. 40; Map 28

Lepyronia gibbosa Ball, 1898:219; Doering 1930:89.

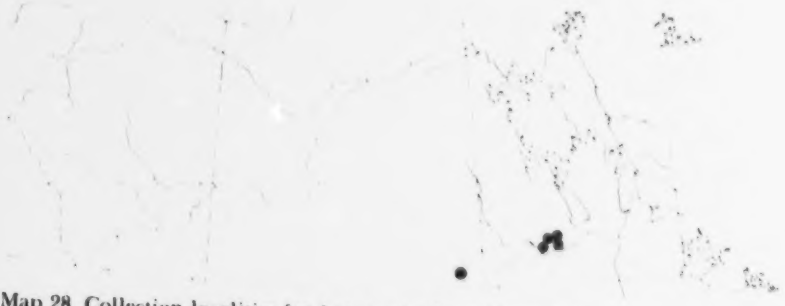
Adults. Distinguished from *Lepyronia angulifera* and *L. quadrangularis* by the strongly inflated sucking pump and small hind wings, and from *L. coleoptrata* by the pointed head. Length: males, 6.9–7.2 mm; females, 8.2–9.6 mm.

Tawny; clothed with fine gray hairs (thus appearing hoary); fore wings usually overlain with dark brown V-shaped marks, together forming a roughly triangular outline.

Local, in sandy or gravelly areas of the Great Plains and northeastern U.S. (Ball 1919).

Hosts. Nymphs are unknown and may be subterranean.

Adults feed on prairie grasses (Doering 1942).



Map 28. Collection localities for *Lepyronia (L.) gibbosa* Ball.

Lepyronia (*Lepyronia*) *angulifera* Uhler

Lepyronia angulifera Uhler, 1876:348; Doering 1930:88.
Lepyronia angulifera var. *minuenda* Ball, 1919:149.
Lepyronia robusta Metcalf and Bruner, 1925:103.

Adults. Distinguished from *Lepyronia gibbosa* by the small size and weakly inflated sucking pump, and from other North American species of *Lepyronia* by the humpbacked appearance. Length: males, 4.0–4.4 mm; females, 5.0–6.1 mm.

Chocolate brown, overlain with blackish brown V-shaped marks on each fore wing (as in Fig. 18), which are sometimes fused across center to form a roughly triangular outline.

Not yet found in Canada. A common species of the Caribbean Islands (Metcalf and Bruner 1943) ranging north in the eastern U.S. (Doering 1930) as far as New Jersey (Uhler 1872). It should be sought (but not expected) in Eastern Canada.

Hosts. Nymphs feed on Bristlegrass (*Setaria geniculata*), Espartillo grass (*Sporobolus indicus*), and sedge (*Cyperus swartzii*) in Cuba (Metcalf and Bruner 1943). Specimens from New Jersey were found in a sphagnum bog (Uhler 1872), possibly feeding on sedges.

Adults have been recorded on Cotton (*Gossypium hirsutum*) (Doering 1942) and are apparently general feeders on a wide variety of plants (Metcalf and Brunner 1943).

Genus *Paraphilaenus* Vilbaste

Fig. 15

Adults. Distinguished from all other Philaenini by the elongate form, large head, and contrasting color pattern. The raised veins of their fore wings resemble those of *Philaenus*, while the short hind wings resemble those of *Philaenarcys*.

One brood per year on sedge.

Paraphilaenus is a boreal genus with one species in the Old World and one in the New World (Hamilton 1979).

Paraphilaenus parallelus (Stearns)

Fig. 15; Map 29

Philaenus parallelus Stearns, 1918:3.
Paraphilaenus parallelus: Hamilton 1979:139.

Map 29. Collection localities for *Paraphilaenus parallelus* (Stearns). Shaded: region of mixed forests of sugar maple, oak, and hemlock.

Adults. Distinguished from pale specimens of *Philaenarcys bilineata* and of *Neophilaenus lineatus* by the broad black stripe down the middle of the back. Length: males, 7.5–8.2 mm; females, 8.6–9.2 mm.

Ochre yellow, paler on outer edges of fore wings, marked with a dark stripe down each fore wing near outer edge, and with a broad black stripe down middle of back that continues along inner edges of fore wings as a brown stripe.

Local, in bogs in mixed sugar maple-oak-hemlock forests of Ontario and Wisconsin. A single specimen has also been reported from central Illinois (Ball 1919).

Hosts. Nymphs are unknown.

Adults feed on sedge (*Carex* sp.) (Stearns 1918, Ball 1919).

Genus *Neophilaenus* Haupt

Fig. 14

Adults. Distinguished from *Philaenarcys* by the narrow fore wings with simple venation, from *Paraphilaenus* by the small size, shorter head, pale stripe down the middle of the back, and fully developed hind wings, and from other Philaenini by the large number of spines at the end of the hind tibia.

One brood per year (Garman 1921), usually on grasses.

Neophilaenus is an Old World genus with one species apparently introduced by man into North America (Hamilton 1979), and now frequently encountered in moist or wet grasslands in southern Canada and the northernmost states of the U.S.

Neophilaenus lineatus (Linnaeus)

Lined spittlebug

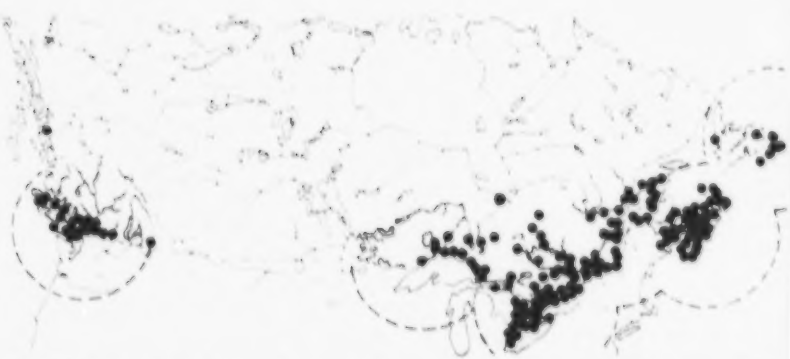
Fig. 14; Map 30

Cicada lineata Linnaeus, 1758:438.
Neophilaenus lineatus: Hamilton 1979:139.

Adults. Distinguished from similarly colored specimens of *Philaenarcys bilineata* by the small size and fully developed hind wings. Specimens of *P. bilineata* that have fully developed hind wings are at least 6.8 mm long. Length: males, 4.2–5.5 mm; females, 5.7–6.2 mm.

Tawny, paler along outer edges of fore wings, marked with a dark stripe down each fore wing near outer edge, and with a lighter stripe (sometimes indistinct) down middle of back; face with pale chevron bordered with brownish black. Occasional specimens may be slightly darker on the fore wing.

Abundant throughout Eastern Canada and northern U.S., except the Great Plains, usually within 500 km radius of a major port, wherever moist grassy conditions prevail (Osborn 1916). Records of "*Philaenus lineatus*" from the Great Plains and inland Alaska refer to *Philaenarcys bilineata*.



Map 30. Collection localities for *Neophilaenus lineatus* (Linnaeus). Shaded circles: 500 km radii from major ports.

Hosts. Nymphs feed on the aerial parts of a wide variety of grasses, including Redtop (*Agrostis gigantea*), Orchard grass (*Dactylis glomerata*), and Timothy (*Phleum pratense*) (Osborn 1916, Garman 1921).

Adults feed on the same hosts as the nymphs, and in addition have been reported from Kentucky blue grass (*Poa pratensis*), willow (*Salix* sp.), maple (*Acer* sp.), and linden (*Tilia* sp.) (Doering 1942).

Genus *Philaenarcys* Hamilton

Figs. 11–13, 83, 84

Adults. Distinguished from *Neophilaenus* and *Paraphilaenus* by the short, stout fore wings with reticulate venation, and from *Philaronia* and *Philaenus* by the more numerous spines at the end of the hind tibia. The hind wings are usually small and not used for flight, like those of *Paraphilaenus*.

One brood per year, on grasses.

Philaenarcys is a native genus of three North American species, all of which occur in Canada (Hamilton 1979).

Key to Canadian species of *Philaenarcys*

1. Gray, with scarcely visible darker lines down back (Fig. 11) ..... ***killa* Hamilton** (p. 66)
   Gray, with prominent darker lines down back (Fig. 12), **or** blackish brown markings extensive (Fig. 13), **or** entirely unmarked yellowish 2
2. Fore wings almost flat, straight along the back, distinctly hairy and not shiny (Figs. 11, 12). Inhabiting inland marshes, inland grasslands, and dry areas above tidal zones ..... ***bilineata* (Say)** (p. 66)
   Fore wings distinctly convex, arched along the back, scarcely haired, and distinctly shiny (Fig. 13). Inhabiting saltwater marshes in tidal zones of the Atlantic coast ..... ***spartina* Hamilton** (p. 68)

Clé des espèces canadiennes du genre *Philaenarcys*

1. Gris et marqué de lignes plus foncées à peine visibles sur le dos (fig. 11) ..... ***killa* Hamilton** (p. 66)
   Gris et marqué de lignes plus foncées distinctes sur le dos (fig. 12) **ou** de grandes taches brun noirâtre (fig. 13), **ou** uniformément jaunâtre 2
2. Ailes antérieures presque plates, droites le long du dos, nettement poilues et non brillantes (fig. 11 et 12). Habite les marais, les prairies intérieures et les portions sèches au-dessus des zones des marées ..... ***bilineata* (Say)** (p. 66)
   Ailes antérieures nettement convexes, courbées le long du dos, à peine poilues et nettement brillantes (fig. 13). Habite les marais d'eau salée des zones des marées, le long des côtes de l'Atlantique ..... ***spartina* Hamilton** (p. 68)

Map 31. Collection localities for *Philaenarcys killa* Hamilton.

Philaenarcys killa Hamilton

Fig. 11; Map 31

Philaenarcys killa Hamilton, 1979:138.

Adults. Distinguished from other species of *Philaenarcys* by the longer, more pointed head, more hairy fore wings, even gray color, and by details of the internal genitalia (Hamilton 1979). Length: males, 5.6–6.0 mm; females, 6.1–6.7 mm.

Brownish gray, with pale bands below eyes and on outer edges of fore wings.

Local, on sand dunes at south end of Lake Huron.

Hosts. Nymphs are unknown, possibly feeding on the subterranean parts of grasses.

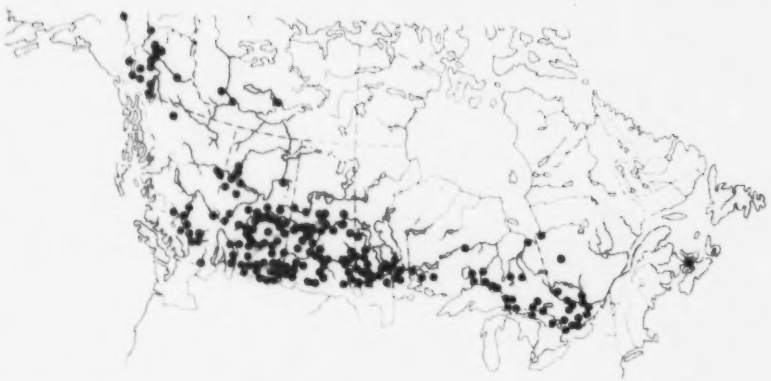
Adults feed on Dune grass (*Calamovilfa longifolia*).

Philaenarcys bilineata (Say)

Prairie spittlebug

Fig. 12; Map 32

Aphrophora bilineata Say, 1831:304.
Ptyelus basivitta Walker, 1851:719.



Map 32. Collection localities for *Philaenarcys bilineata* (Say). Shaded: region of summer temperatures (above 5.5°C) of more than 800 degree-days per year.

Philaenus lineatus: Uhler 1876:347 (not Linnaeus' *lineatus*; see *Neophilaenus lineatus*).
Philaenus americanus Baker, 1897:112.
Philaronia bilineata var. *reticula* Ball, 1919:144.
Philaronia bilineata var. *nigricans* Ball, 1919:144.
Philaronia bilineata var. *orbiculata* Ball, 1919:145.
Philaronia bilineata var. *infuscatus* Stearns, 1923:230.
Philaronia bilineata var. *pallidus* Stearns, 1923:230.
Philaenarcys bilineata: Hamilton 1979:138.
Philaronia abjecta: Strickland 1953:204 (not Uhler's *abjecta*; see *Philaronia abjecta*).

Adults. Distinguished from *Philaenarcys killa* by the shorter, blunter head and dark stripes down the back (absent only in yellow or blackish forms), and from *Philaenarcys spartina* by the straight fore wings with prominent hairs. The internal genitalia also give useful characters for distinguishing among these species (Hamilton 1979). Length: males, 5.1–6.8 mm; females, 5.6–8.0 mm.

Color variable, from entirely ochre yellow, to blackish brown with only outer edges of fore wings pale. The two most common color varieties are intermediate between these two extremes: grayish yellow marked with dark brown stripes down the middle of back and along each fore wing near outer edge (Fig. 12), or blackish brown with edges and tips of fore wings pale (as in Fig. 13). In general, pale specimens are usually encountered in stands of tall grasses, dark specimens in short grasses.

Abundant on the Great Plains of North America, and in reedgrass marshes, heaths, and other native grass stands throughout Canada, except for the arctic and subarctic zones; rarer eastward. Records of "*Philaenus lineatus*" from the boreal zone and from the prairies and to "*Philaronia abjecta*" from Canada refer to *Philaenarcys bilineata*.

Hosts. Nymphs are unknown.

Adults feed on Marsh reedgrass, or Blue-joint, (*Calamagrostis canadensis*), Bent grass (*Agrostis* sp.), and probably many other native grasses; they are also reported on Alfalfa (*Medicago sativa*) (Doering 1942).

Philaenarcys spartina Hamilton

Saltmarsh spittlebug

Figs. 13, 83, 84; Map 33

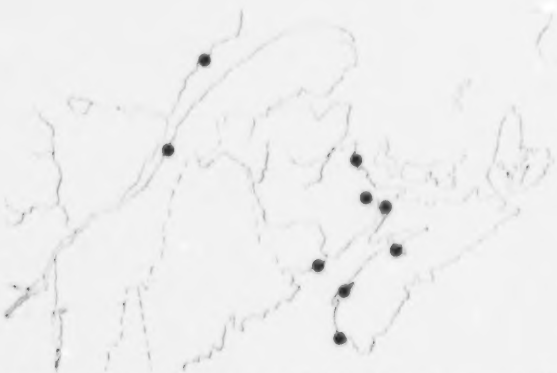
Philaronia bilineata: Barber and Ellis 1922:1 (not Say's *bilineata*; see previous species).

Philaenarcys spartina Hamilton, 1979:136.

Adults. Distinguished from other species of *Philaenarcys* by the convex, arched, shiny fore wings and by details of the internal genitalia (Hamilton 1979). Length: males, 6.1–6.9 mm; females, 7.0–7.9 mm.

Color variable, from grayish yellow marked with dark brown stripes down the middle of back and along each fore wing near outer edge (as in Fig. 12), to blackish brown with edges and tips of fore wings pale (Fig. 13).

Locally abundant along Atlantic coast in tidal salt marshes where its hosts are found.



Map 33. Collection localities for *Philaenarcys spartina* Hamilton.

Hosts. Nymphs feed on the upper parts of cord grasses (*Spartina* spp.), preferring Salt hay (*Spartina patens*), but also occurring on stunted growth of *S. alterniflora* (O. Krepinsky, personal communication).

Adults feed on Prairie cord grass (*Spartina pectinata*) and Salt hay (*Spartina patens*), preferring low growth stands.

Genus *Philaronia* Ball

Figs. 9–10

Adults. Distinguished from other genera of the Philaenini by the distinctly hairy fore wings and branching veins around the tips of the fore wings, and from the superficially similar genus *Lepyronia* by the double-ridged margin of the crown.

Two broods per year, on various broad-leaved herbaceous plants.

Philaronia is a genus native to the New World, with six species (Hamilton 1982), two of which inhabit Canada and the U.S.

Key to Canadian species of *Philaronia*

1. Body short, stout. Fore wings more than two-fifths as wide as long (Fig. 9). Inhabiting southern Ontario ..... ***canadensis*** **(Walley)** (p. 69)
Body long, slender. Fore wings less than two-fifths as wide as long (Fig. 10). Inhabiting the Great Plains ..... ***abjecta*** **(Uhler)** (p. 70)

Clé des espèces canadiennes du genre *Philaronia*

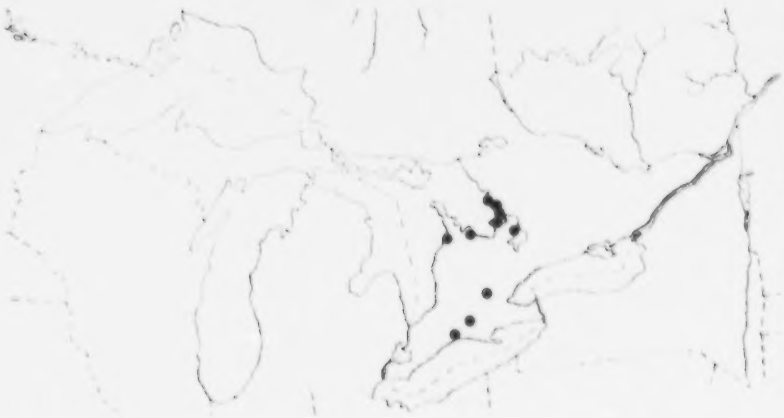
1. Corps court et trapu. La largeur des ailes antérieures est supérieure aux deux cinquièmes de leur longueur (fig. 9). Habite le sud de l'Ontario .....
..... ***canadensis*** **(Walley)** (p. 69)
Corps long et élancé. La largeur des ailes antérieures est inférieure aux deux cinquièmes de leur longueur (fig. 10). Habite les Prairies .....
..... ***abjecta*** **(Uhler)** (p. 70)

Philaronia canadensis (Walley)

Fig. 9; Map 35

Philaronia abjecta: Ball 1928:49 (not Uhler's *abjecta*; see next species).
Philaenus canadensis Walley, 1929:156.
Philaronia canadensis: Hamilton 1979:135.

Adults. Distinguished from *Philaronia abjecta* by the slightly more pointed head, the shorter and stouter form (together giving the insect a somewhat oval shape when viewed from above), and the fore wing venation



Map 34. Collection localities for *Philaronia canadensis* (Walley). Shaded: region of more than 140 frost-free days per year.

being seldom reticulate, having only a few irregular vein forkings along the edge of the wing. Length: males, 5.4–6.2 mm; females, 6.0–6.7 mm.

Chocolate to blackish brown; face yellow in males of spring brood, and in both sexes of fall brood.

Local, in river bottoms and along lake shores in mild parts of southern Ontario. This species has also been taken as far south as South Carolina (Hamilton 1979).

Hosts. Nymphs are unknown; they probably feed on the subterranean parts of herbaceous plants, as do the nymphs of *P. abjecta*.

Adults have been taken on Goldenrod (*Solidago* sp.).

Philaronia abjecta (Uhler)

Fig. 10

Philaenus abjectus Uhler, 1876:346.
Philaronia abjecta var. *provana* Ball, 1919:145.
Philaronia abjecta: Hamilton 1979:135.

Adults. Distinguished from *Philaronia canadensis* by the blunter, more sloping crown, narrower fore wings, and more distinctly reticulate venation. Length: males, 5.9–6.3 mm; females, 5.8–6.5 mm.

Brown, darker in spring brood, paler in fall brood; face yellow in males of spring brood, and in both sexes of fall brood.

Not yet found in Canada. Records of *P. abjecta* from Manitoba and Alberta apparently refer to dark specimens *Philaenarcys bilineata*. *P. abjecta* is common in arid regions of the Colorado foothills, and may be expected to inhabit similar localities in Alberta.

Hosts. Nymphs feed on the subterranean stems and roots of lupine (*Lupinus* sp.) and wild geranium (*Geranium* sp.) (Ball 1915).

Adults feed on Stinking rabbitbrush (*Chrysothamnus viscidoflorus*), Bigtooth sunflower (*Helianthus grosseserratus*), Russian-thistle (*Salsola pestifer*), and California juniper (*Juniperus californica*) (Doering 1942).

Genus *Philaenus* Stål

Fig. 8

Adults. Distinguished from other Philaenini by the small number (7–10) of spines at the end of the hind tibia (Fig. 4) and by the nearly hairless fore wings. All the members of this genus are enormously variable in color pattern, and may resemble other spittlebugs superficially. Prior to 1955, "*Philaenus*" of North American authors also included *Neophilaenus* Haupt and *Paraphilaenus* Vilbaste.

One brood per year (Osborn 1916) on various broad-leaved herbaceous plants, and sometimes also on grasses, shrubs, and even trees.

Philaenus is an Old World genus with one species introduced by man into North America (Hamilton 1979) and now the most frequently encountered of the spittlebug genera in moist agricultural situations throughout the continent.

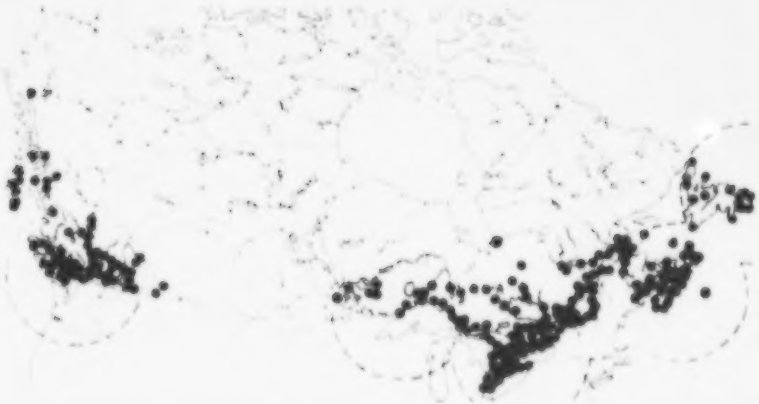
Philaenus spumarius (Linnaeus)

Meadow spittlebug

Figs. 4, 7, 8; Map 34

Cicada spumaria Linnaeus, 1758:437.
Cicada leucophthalmus Linnaeus, 1758:437.
Cicada oenotherae Scopoli, 1763:114.
Cicada quadrimaculata Schrank, 1776:77.
Ptyelus albiceps Provancher, 1890:257.
Philaenus tesselatus Melichar, 1899:183.
Philaenus spumarius: Hamilton 1979:128.

Adults. Distinguished from other members of the Philaenini by the characters cited under *Philaenus* and from the superficially similar species *Aphrophora (Aphrophora) quadrinotata* Say by the smooth fore wings (not bearing prominent pits) and by the double-ridged margin of the crown. Length: males, 5.2–6.4 mm; females, 5.4–6.8 mm.



Map 35. Collection localities for *Philaenus spumarius* (Linnaeus). Shaded circles: 500 km radii from major ports.

Color variable, from tawny to ochre yellow, black, or reddish, more or less mottled with brown or marked with black; head with two spots at tip (Fig. 7).

Abundant throughout eastern and western temperate North America, from James Bay south to northern Georgia in the east and from the Alaskan panhandle south to California in the west, but not occurring on the Great Plains (Weaver and King 1954). This species is usually found within 500 km radius of a major port, but also inhabits the offshore islands of the Atlantic and Pacific oceans, and is the only spittlebug taken on Sable Island, 225 km off the shore of Nova Scotia.

Four subspecies of *P. spumarius* are known (Hamilton 1979). The common and economically important insect throughout most of North America is subspecies *quadrimaculatus*. Subspecies *spumarius* is the dominant subspecies in Newfoundland, except for the Avalon and Burin peninsulas, where *spumarius-quadrimaculatus* intermediates are dominant. Subspecies *oenotherae* and *tesselatus* are probably not represented by pure populations anywhere on this continent.

Hosts. Nymphs feed on the aerial parts of numerous hosts, mostly broad-leaved herbaceous plants, but also grasses, shrubs, and shoots of deciduous trees (Osborn 1916). Three hundred and eighty different hosts are recorded; this is probably just a partial list, as *spumarius* nymphs may feed on any sufficiently succulent plant (Weaver and King 1954).

Adults feed on the same hosts as the nymphs (Osborn 1916, Weaver and King 1954).

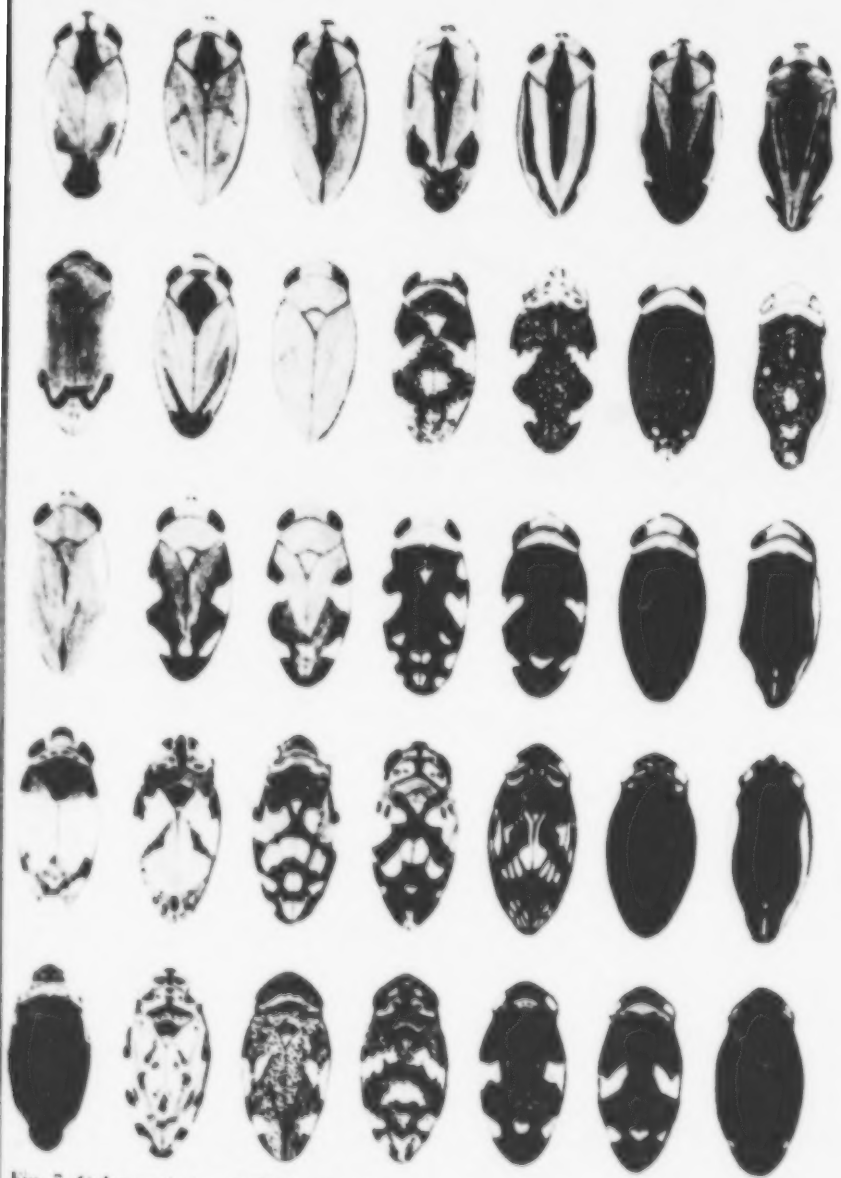


Fig. 7. Color varieties of *Philaenus spumarius* (Linnaeus).

8

Philaenus spumarius
(Linnaeus)

9

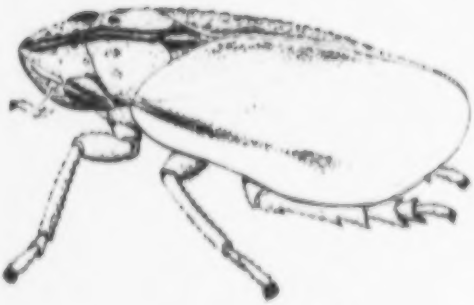
Philaronia canadensis
(Walley)

10

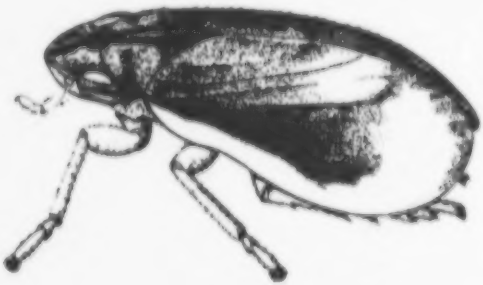
Philaronia abjecta
(Uhler)

Figs. 8–10. Spittlebug species as labeled.

11
Philaenarcys killa
Hamilton



12
Philaenarcys bilineata
(Say)

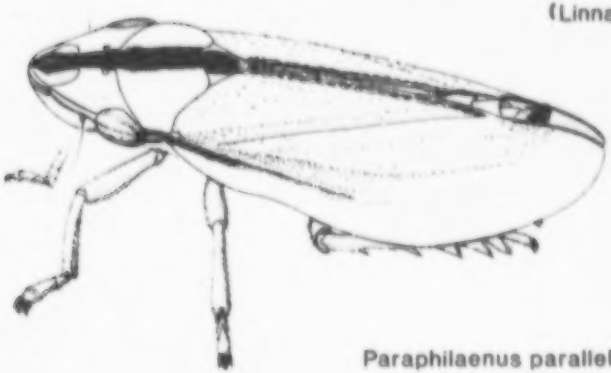


13
Philaenarcys spartina
Hamilton

Figs. 11-13. Spittlebug species as labeled.

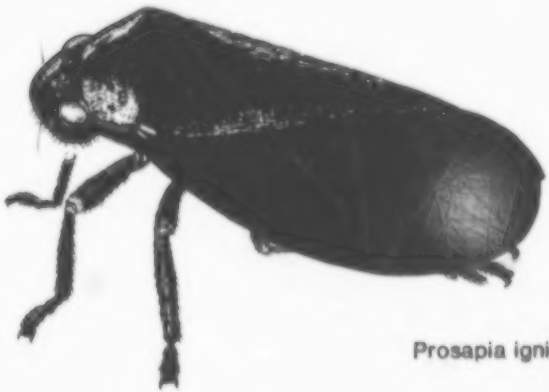
14

Neophilaenus lineatus
(Linnaeus)



15

Paraphilaenus parallelus
(Stearns)

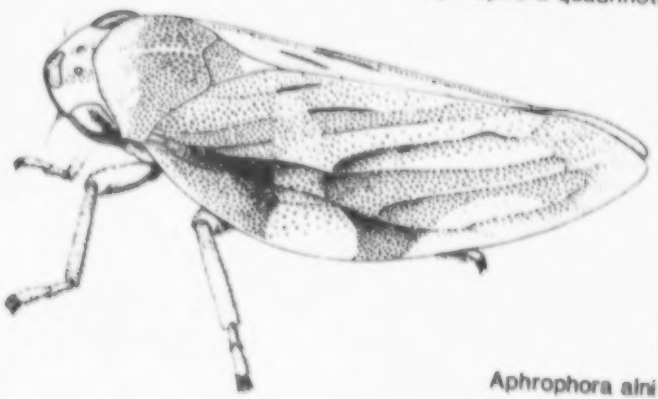


16

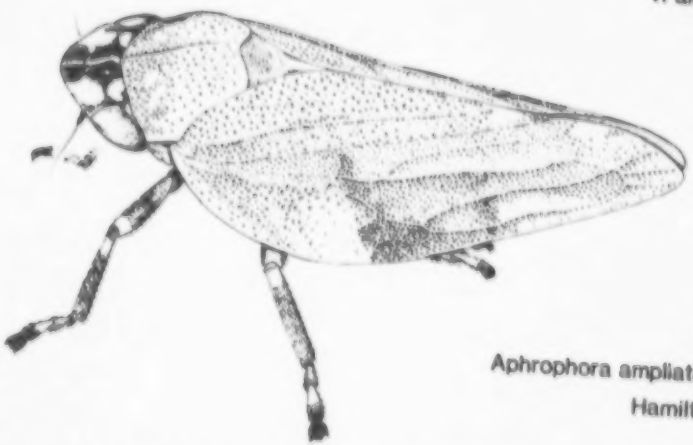
Prosapia ignipectus
(Fitch)

Figs. 14–16. Spittlebug species as labeled.

17
Aphrophora quadrinotata
Say

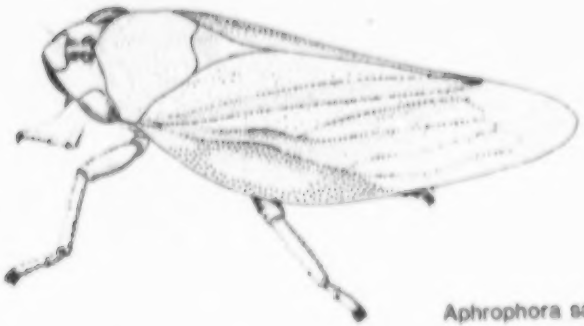


18
Aphrophora alni
(Fallén)



19
Aphrophora ampliata
Hamilton

Figs. 17–19. Spittlebug species as labeled.



20
Aphrophora salicis
(DeGeer)

21
Aphrophora princeps
Walley

22
A. ampliata

23
A. princeps

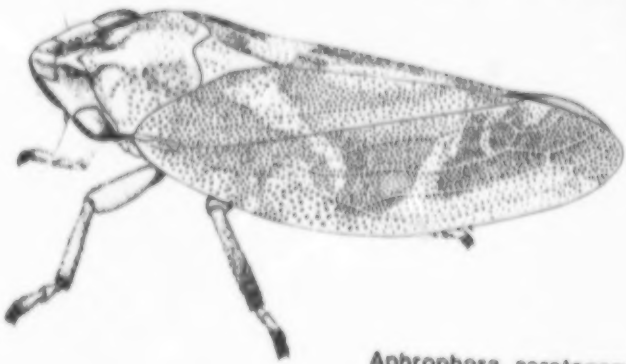
24
Aphrophora regina
Hamilton

Figs. 20–24. Spittlebug species as labeled.

25

Aphrophora parallella

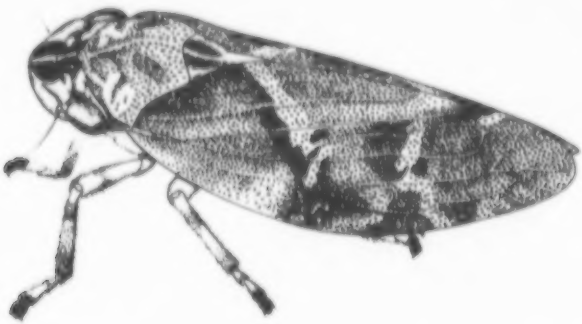
(Say)



26

Aphrophora saratogensis

(Fitch)



27

Aphrophora gelida

(Walker)

Figs. 25–27. Spittlebug species as labeled.

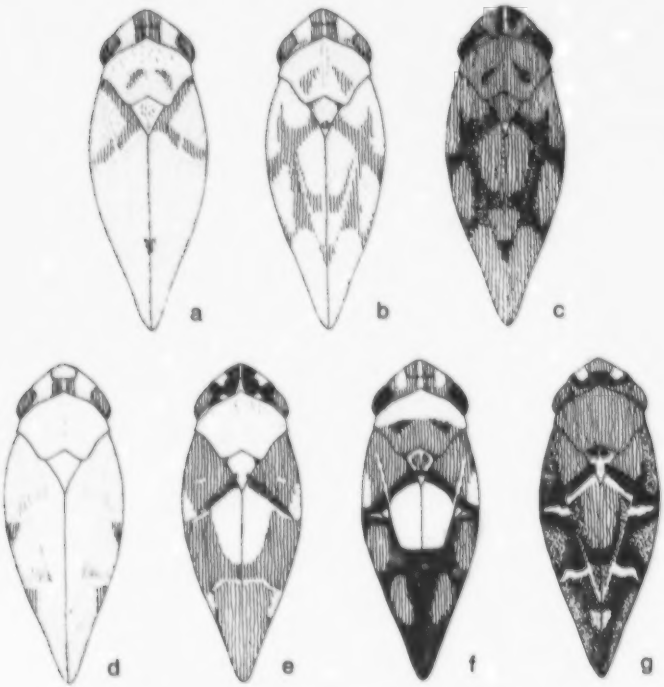
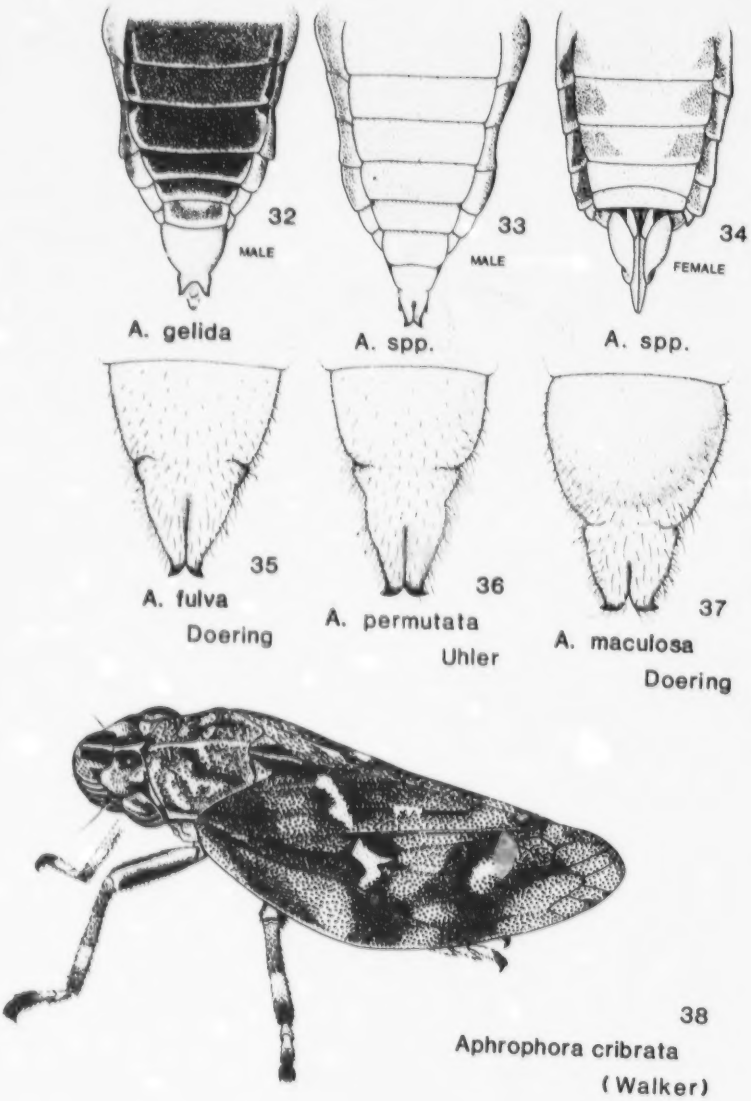


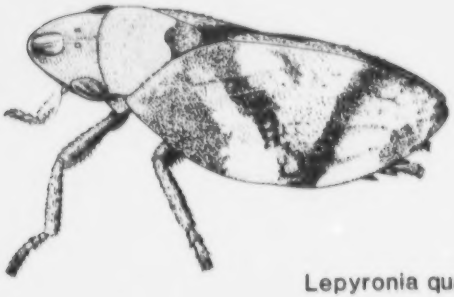
Fig. 28. Color varieties of *Aphrophora* (*Plesiommata*) *gelida* (Walker), *A.* (*P.*) *fulva* Doering, *A.* (*P.*) *permutata* Uhler, and *A.* (*P.*) *maculosa* Doering. Vertical stripes: brown; dots: pale brown; vermiculate lines: irregular dark markings; white areas: tawny to yellow; black areas: dark brown to black.

Figs. 29–31. Heads and pronota of *Aphrophora* (*Plesiommata*) spp., viewed from above. Species as labeled.



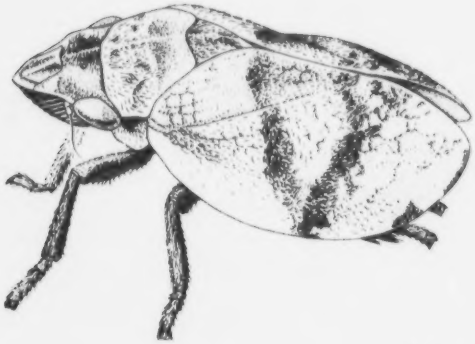
Figs. 32–37. Abdomens of *Aphrophora* (*Plesiommata*) spp., viewed from below, the last three with terminal segments enlarged. Sex and species as labeled.

Fig. 38. Spittlebug species as labeled.



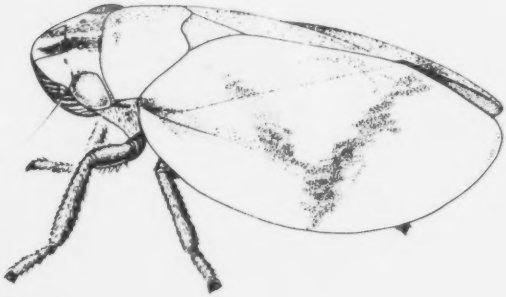
39

Lepyronia quadrangularis
(Say)



40

Lepyronia gibbosa
Ball

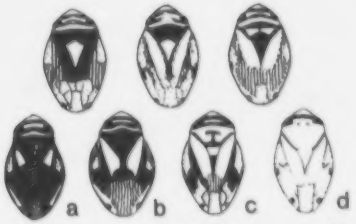


41

Lepyronia coleoptrata
(Linnaeus)

Figs. 39–41. Spittlebug species as labeled.

42



43

Clastoptera proteus Fitch

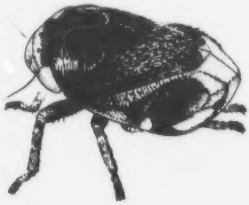
44

45

Clastoptera saintcyri Provancher

46

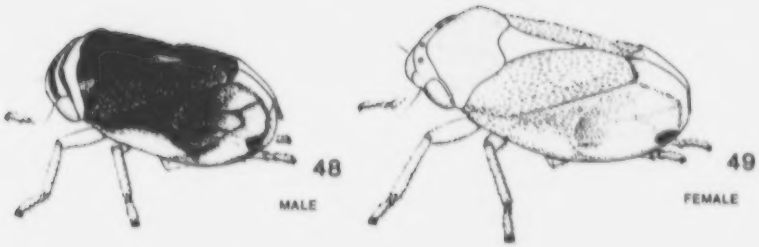
Clastoptera hyperici Gibson



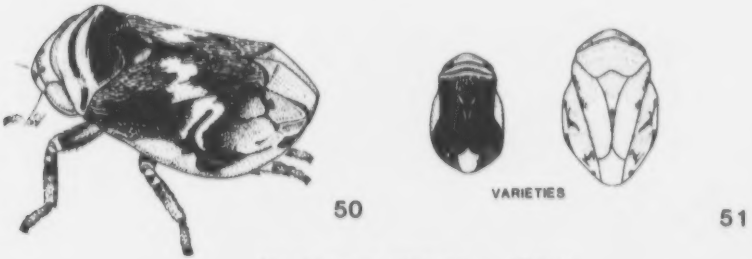
47

Clastoptera xanthocephala Germar

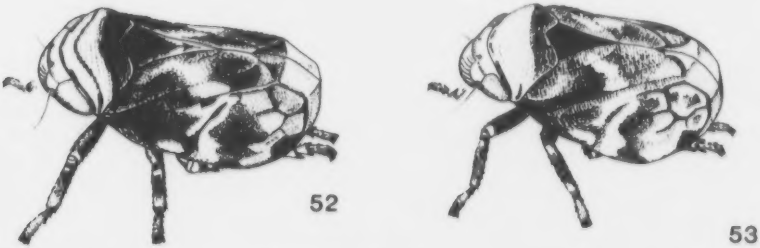
Figs. 42–47. Spittlebug species as labeled.



Clastoptera testacea Fitch



Clastoptera obtusa (Say)



Clastoptera ovata Doering

Figs. 48–53. Spittlebug species as labeled.

54

Clastoptera doeringae
Hamilton

55

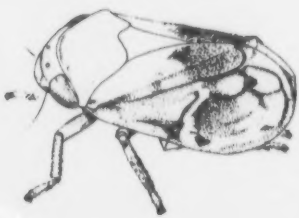
PALE VARIETY

56

Clastoptera arborina
Ball

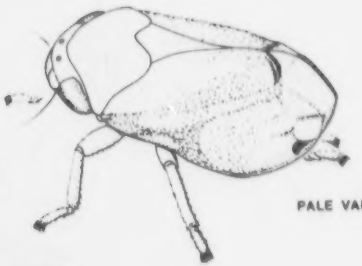
57

Clastoptera juniperina
Ball



58

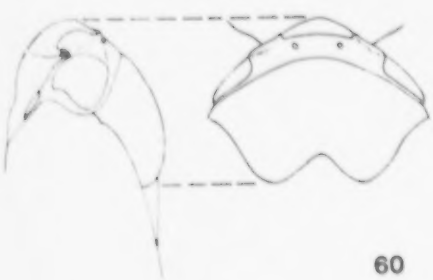
Clastoptera achatina Germar



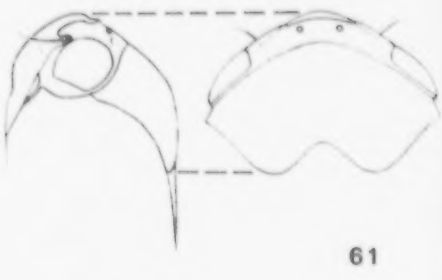
59

PALE VARIETY

Figs. 54–59. Spittlebug species as labeled.



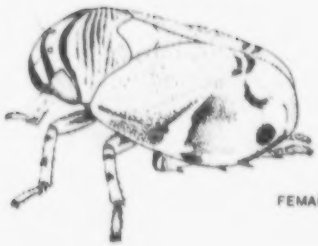
60



61

62

MALE



63

FEMALE

Clastoptera atrapicata Hamilton

MALE

64

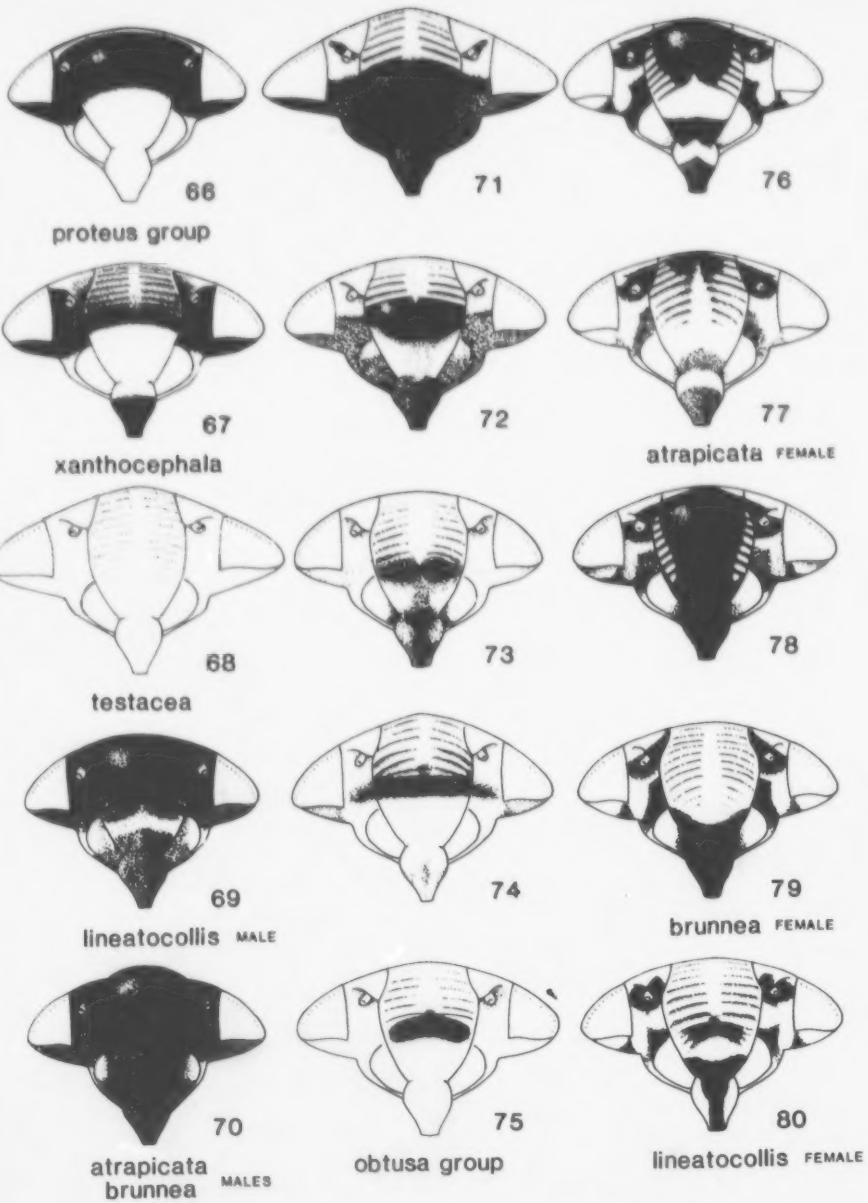
Clastoptera brunnea Ball

65

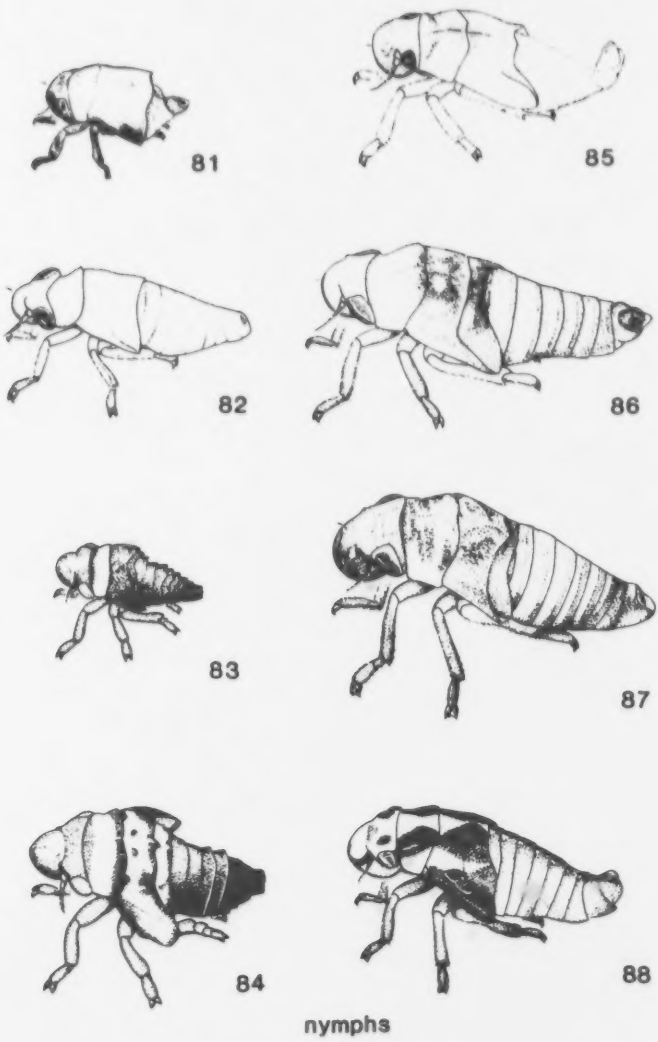
Clastoptera delicata Uhler

Figs. 60, 61. Heads and pronota of *Clastoptera* spp., viewed from the side, and from directly above. 60, *C. atrapicata* Hamilton; 61, *C. brunnea* Ball.

Figs. 62–65. Spittlebug species as labeled.



Figs. 66–80. Heads of *Clastoptera* spp. viewed from below (face view). 66, *C. proteus* Fitch (*C. saintcyri* Provancher and *C. hyperici* similar); 67, *C. xanthocephala* Germar; 68, *C. testacea* Fitch; 69, *C. lineatocollis* Stål, male; 70, *C. atrapicata* Hamilton, male (*C. brunnea* Ball, male, similar); 71, 72, *C. obtusa* (Say); 73, *C. achatina* Germar (may be as dark as in Fig. 72); 74, *C. ovata* Doering; 75, *C. doeringae* Hamilton (*C. arborina* Ball and *C. juniperina* Ball similar); 76, 77, *C. atrapicata* Hamilton, females; 78, 79, *C. brunnea* Ball, females; 80, *C. lineatocollis* Stål, female.



Figs. 81–88. Nymphs of Cercopidae. 81, *Clastoptera obtusa* (Say); 82, *Philaenus spumarius* (Linnaeus); 83, *Philaenarcys spartina* Hamilton, fourth instar; 84, same, fifth instar; 85, *Prosapia ignipectus* (Fitch); 86, *Aphrophora* (*Plesiommata*) *gelida* (Walker); 87, *Aphrophora* (*Pinimber*) *cribrata* (Walker); 88, *Lepyronia* (L.) *coleoptrata* (Linnaeus).

Glossary

(Internal structures, wing parts, and genitalia not included.)

anteclypeus The clypellus.
anteriad Toward the mouth.

bulla A wartlike hump (near the tip of the fore wing in Clastopterini).

cephalad Toward the head.
claval suture The groove dividing the clavus from the rest of the fore wing.
clavus (pl. **clavi**) A triangular portion of the hind margin of the fore wing, bounded on two sides by the margins of the wing, and on the third by a deep groove.
clypeal suture A groove (poorly defined in spittlebugs) between the lower surface of the sucking pump and the clypellus.
clypellus The convex plate overlapping the mouth, below the sucking pump.
clypeus Variously used to denote the clypellus or the sucking pump.
commissure Inner edge of clavi where folded fore wings meet each other.
coronal suture The ridge, or groove, down the center of the crown in adults; or the zone of cuticular weakness down the center of the head where the exoskeleton of the immature insect splits when the cuticle is shed.
costa The front edge of the fore wing; when the wings are folded over the back this becomes their outer edge.
coxa (pl. **coxae**) The basal segment of the leg; in spittlebugs short, stout, and conical.
crown The upper surface of the head between the compound eyes.

distal Toward the tip (away from the base).
dorsad Upward (toward the dorsum).
dorsum The upper part of the body, including the crown, pronotum, and tergites.

empodium A fleshy pad between the claws.
epimeron The pleurite behind the pleural suture.
epipharynx Sometimes used to denote the labrum; correctly its inner edge (in the mouth cavity).
episternum The pleurite in front of the pleural suture.
epistomal suture Variously used to denote the clypeal suture or the hind margin of the tylus.

face The lower surface of the head between the compound eyes.
femur (pl. **femora**) The third segment of the leg from the base (Fig. 6).
frons (or **front**) Variously used to denote the tylus or the outer surface of the sucking pump.
frontal suture The hind and side margins of the tylus in adults; or the zone of cuticular weakness extending across the front of the head where the exoskeleton of the immature insect splits when the cuticle is shed.

frontoclypeus The outer surface of the sucking pump.
fuscous Blackish brown.

gena (pl. **genae**) The side of the head, below the eye and above the lorum.
gibbous Humpbacked.

hemelytron (pl. **hemelytra**) The fore wing.
hyaline Glassy.
hypandrium The male genital segment, excluding the plates and internal parts.

irrorate Freckled.

labium The beak.
labrum A tiny triangular flap below the clypellus, covering the mouth, and fitting into a groove at the base of the beak.
laterad Toward the side.
lorum (pl. **lora**) An oval plate, lying on either side of the lower part of the sucking pump and also flanking the clypellus (Figs. 66–80).

mandibular sclerite The lorum.
maxillary sclerite The narrow rim around the outer edge of the lorum.
meron (pl. **mera**) A triangular process of the coxa.
meso- Belonging to the second thoracic segment.
mesad Toward the midline.
meta- Belonging to the third thoracic segment.

nervures The wing veins.
notum The tergum of the thorax (usually combined with a prefix to denote the segment in question, e.g., pronotum).

occiput The hind surface of the head, which is pressed against the thorax and thus usually not visible.
ocellus (pl. **ocelli**) The simple eyes, a pair of which are placed on the crown in Cercopidae.

pecten The row of spines at the end of the hind leg; sometimes also referring to those on each foot segment.
piceous Black.
plates Flaplike sternal appendages (paired) of the male ninth abdominal segment.
pleural suture A groove up the side of each thoracic segment, beginning at the coxa, and ending below the base of the wing on the second and third segments.
pleurite A plate on the pleuron.
pleuron (pl. **pleura**) The sides, between the tergum and sternum.
postclypeus The sucking pump.
postcoxale A narrow sternal band behind each coxa.
posteriad Toward the hind end; backward.
postscutellum A narrow part of the mesonotum behind the scutellum, usually covered by the fore wings.

prescutum A triangular part of the mesonotum forming the front margin of the scutum; hidden by the pronotum.
prealare A narrow band in front of the base of each wing connecting the notum to the pleuron.
precoxale A narrow sternal band in front of each coxa.
presternum The front half of each thoracic sternum, connecting the precoxales.
pretarsus (pl. **pretarsi**) The claws and empodium of each foot.
pro- Belonging to the first thoracic segment.
pronotum The upper part of the first thoracic segment.
proximal Toward the base.
pubescent Finely haired.
punctate Pitted all over.
pygofer The sides of the hypandrium, usually produced as lobes, hooks, or spines.

rostrum The beak.
rufous Reddish.

scutum The convex part of the mesonota and metanota, which forms most of the notum of each winged segment; the mesoscutum is concealed by the pronotum, the metascutum by the folded fore wings and the scutellum.
sclerite A hard part of the cuticle, bounded by grooves or membranes.
sclerotized Variously used to denote a hardened, or a tanned part of the cuticle.
scutellum The exposed part of the upper surface of the second thoracic segment.
sternellum The hind part of each thoracic sternum, connecting the postcoxales.
sternite A plate on the sternum.
sternum (pl. **sterna**) The middle of the lower surface of the body, between the pleura.
stramineous Straw colored.
striate With parallel lines or grooves.
stylets The needlelike mouthparts, which are enclosed in the beak and serve to puncture the tissue of the host plant.

tarsomere A segment of the tarsus.
tarsus (pl. **tarsi**) The small terminal segments of the leg, exclusive of the claws and associated structures.
tegmen (pl. **tegmina**) The fore wing.
telson The tip of the body, enclosing the anus, extending beyond the genital segment.
tergite A single plate on the tergum.
tergum The upper cuticular plates of the body; in the abdomen, this region may be very large, extending in an unbroken curve around to the lower side, as in the spittlebugs.

testaceous Clay colored; varying in meaning from yellow brown to orange brown or ochre yellow.

tibia (pl. **tibiae**) The fourth segment of the leg from the base (Fig. 6).

transclypeal suture The clypeal suture.

trochanter The second segment of the leg, between the coxa and the femur; in spittlebugs this segment is small and curved, often difficult to distinguish from the coxa.

trochantin A small, crescent-shaped ridge connecting the front part of the coxa to the pleuron, and assisting in rotating the leg base.

tylus The ovoid or bean-shaped part of the crown formed by the outer surface of the sucking pump.

valve A knifelike part of the ovipositor, or its sheath.

valvifer The rounded base of each valve, visible at the base of the ovipositor (Fig. 2).

valvula (pl. **valvulae**) The valve.

vein A thickened ridge providing structural support to the wing membrane.

venter The lower surface of the body; in spittlebugs consists of the face, sternum, pleura, and the sides of the terga of the abdomen.

ventrad Toward the lower surface of the body; downward.

vertex The crown of the head, exclusive of the tylus.

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